COLLECTED ESSAYS
IN PREVENTIVE MEDICINE:
WITH
GLYCOSURIA.

WILLIAM SQUIRE M.D.
F.R.C.P

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MACLACHLAN & STEWART
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COLLECTED ESSAYS IN PREVENTIVE MEDICINE:

INFECTION & DISINFECTION,

TEMPERATURE OBSERVATIONS ON CHILDREN,

THE PERIOD OF

INFECTION IN EPIDEMIC DISEASES,

AND THE RENAL SIGNS OF

DISORDERS OF NUTRITION,

BY

WILLIAM SQUIRE, M.D., F.R.C.P.

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ESSAYS IN PREVENTIVE MEDICINE.

INTRODUCTION:—These essays have aimed at setting forth some general hygienic and physiological truths; such as may help us against much avoidable illness, and may usefully be kept in mind during our efforts to prevent the more widely diffused infectious fevers.

Our first stand against diseases is based on a full knowledge of the characters of health; in this way only is that early recognition of departure from the healthy standard secured which is of chief importance in the avoidance of further mischief. It is not enough for the purposes of defence to know the symptoms of special illnesses, the natural history of each, or the earliest signs of ingress; but the normal variation of the pulse, respiration, temperature, secretions, growth and weight of the individual at different ages, and under varying conditions must be studied and known. Any gain in certainties of this kind, however slowly won, steadily advances the art of medicine.

The titles or headings to the essays here brought together, sufficiently indicate their special objects; each must speak for itself as to how far it helps to the attainment of the general idea. The methods followed are those of my masters in medicine, Dr. WALTER HAYLE WALSHE, and SIR WILLIAM JENNER; these have led me to separate rubella from both rubeola and roseola, and to set catarrhal croup apart from diphtheria. Therapeutic details are omitted because of the opportunity afforded me by two of my oldest friends—Dr. RUSSELL REYNOLDS and Dr. QUAIN—in the monumental works on medicine they have edited, to set forth in full in the "System" and "Dictionary," not only my views on the most prevalent and most fatal of the common infective fevers, but my ideas as to their treatment. In "A System of Medicine" an old and close intimacy with the editor, not only first set my observations among children into "act and use," but enabled me to show that, if active means were sometimes necessary against croup, the number of cases in which they were uncalled-for preponderated and was then enormously on the increase in London,—a warning much wanted at the time, but now less needed with our wider knowledge of septic influence in acute diseases. The analogies of erysipelas and diphtheria are dwelt upon in the "System;" and the therapeutic idea of aiding the resistance of the body against the encroachments of "germs," rather than to the use of germicides, is accepted. Later experience shews how little influence antiseptics exert over the course of the infective fevers. The sulpho-carbolates are disused; the power of Salicylic acid is defined, and this prevails against acute rheumatism where no specific germ is found. A use for antiseptics occurs in the treatment of Diarrhœa by acids inimicable to the associated germs. Dilute Sulphuric Acid has well-nigh displaced the old chalk mixture. M. Lesage has shewn that Hydrochloric or Lactic Acids, at 2 per cent., arrest the green ferment so frequent with children (see p. 68), and are thus more available in infantile diarrhœa than mercurial powders, or the newer use of the perchloride. Much has been gained of late in general therapeutics that is necessary to a right judgment in the use of drugs; but a knowledge of the natural history of disease must precede treatment, and neither bleeding nor aconite nor the new antipyretics need be employed in cases when the raised pulse or high temperature will undergo a sudden fall, often in a few hours, in the known course of the ailment.

The class of preventable diseases, already a large one, extends much beyond our present view. Starting with the infections from without, and how to restrict their effects, we soon find that there are autogenetic poisons to be guarded against, and often requiring similar means and care for their avoidance; as the horizon widens many other diseases become included. Some forms of Heart Disease and of Bright's Disease, secondary to processes brought more and more under our control, such as Rheumatic Fever and Kidney irritation, are greatly lessened and often prevented, not only by early and proper care, but by our direct medical intervention, as with the salicylates in the one case, and by pilocarpine or suitable medication in the other. Acute Rheumatism is so constantly shortened by the conveyance of the Salicylic antiferment to the tissues and fluids of the body during this disease process that it may in one sense be called Zymotic. Its arrest indirectly prevents the Heart Disease otherwise so frequent. The reaction of any disturbance of one part of the body on the functions of the other organs is well known in the causation of preventable disease. Impaired or enfeebled heart may cause hepatic or pulmonary congestions; excited cardiac action leads to rigid arteries and kidney disease with reciprocal injury. In these cases, to relieve or moderate the mischief at one point is to diminish it all round.

Taking the wider view of this subject, many of the diseases dependent upon defective nutrition and some of the so-called constitutional disorders are brought within the sphere of a rational and effective preventive medicine. There are forms of inherited disease, the enthetic, to be eradicated by medical treatment on timely recognition. Rickets, totally distinct from this and from Struma, is prevented by pure air and right food. The modern view of strumous and phthisical diatheses is against the supposition of inherited tubercle, but an inherited tendency to develope this form of disease must be admitted; also that much may be done for the susceptible to ward off its incidence by an abundance of fresh air, by a dietary rich in easily assimilable carbohydrates, and by such exercise as tends to free chest expansion, while extra care is taken to avoid local congestions. Tubercular accidents are frequent in convalescence from the infective fevers, so that to prevent one is to prevent the other. All that favours healthy growth in childhood and prevents arrest of development also prevents the disabilities and disease that would otherwise ensue.

ON INFECTION AND DISINFECTION.

SANITATION twenty years ago meant good drainage, a wholesome water supply, and air untainted by any common nuisance that could be abated or removed. The immediate gain from measures then urged forward was great, and no wonder; cleanliness, with purity of air and water, must always be the basis of hygiene. Many of the well-named "filth diseases" were prevented, some diminution was noticed in the prevalence of comsumption, improvement was even hoped for in the common infective fevers; for was it not possible that some of them might arise from decomposition or damp, and probable that their fatality was increased by insanitary surroundings? The latter of these suppositions is well founded, the former has had to be gradually relinquished. A specific 'germ' is concerned in all infective disease. Such a one is found in Phthisis; another is propagated in outbreaks of Enteric fever; the necessity for such an agency in Malarial fever is generally admitted, even if the *bacillus malariæ* of Klebs and Tommasi-Crudeli had no better acceptance than the Cholera *komma.*

Proofs of the latter of the above suppositions abound. Very often the greater severity of Measles leads to the discovery of something wrong about the house; or the fatality of scarlet fever is traced to a local sanitary defect; should this not be discovered and remedied, all attempts to remove infection may fail. A house has been unoccupied for a year, and for another six months under repair, but old drains and a cess-pit remaining infection has seized the new comers soon after commencing residence. Yet with full attention to such sanitary matters in Scarlet fever, and also to the one necessary precaution against Small-pox, both those diseases have occurred in their greatest severity since the era of sanitation was fully inaugurated; nor has the prevalence of Measles, Rubella, Mumps, Varicella or Whooping Cough been in any degree lessened. The reason of this is that one factor, that of infection, has been disregarded or kept in the background. Much has been said of 'wash and be clean,' little of 'do as you would be done by,' the chief maxim to be acted on in restricting the spread of infectious diseases; if you would not wish infection to be brought into your own house or family avoid all risk of being, in any way, the medium of taking it elsewhere. To make it possible to act up to this rule, the laws of infection for each of the infective fevers should be known; and, one must always bear in mind that it is the slightest forms of these diseases that mostly carry infection; the sufferers from the more severe attacks are confined to their rooms, and are seldom the cause of any spread of infection while they are under the charge of nurses and doctors. There remain the dangers of convalescence, against which, also, it is the object of these pages to give some words of caution.

Scarlet fever differs from small-pox in three important particulars;

first, in the shortness of the incubation period, or the rapidity with which the disease is declared; secondly, in the variety and duration of the complications which follow; thirdly, in the long convalescence and increased length of time during which infection persists. Separate wards are required for cases of different degrees of severity, and unless a convalescent department is available, the length of time necessary to retain patients in hospital, lest they should be a source of danger to others, is double that for small pox,—thus crippling the amount of hospital accommodation for acute cases by half the whole number of beds.

Vaccination affords a protection against small-pox hardly to be hoped for in any other disease of this class. No modified form of scarlet fever will ensure against its recurrence in a more severe form. Were we to inoculate from a mild case of the disease, it is likely we should set up a severe, and it might be a fatal attack; however mild a form might result it would involve the danger of infecting others, and every case risks the well-known after-complications. The modified disease lately discovered in the cow produces a slight form of illness in some cases, but not in all. The milder epidemics, conveyed through the medium of milk would continue to spread, and give rise to serious effects, if not so narrowly watched to their end. A first case of scarlet fever is often of a mild character, while a second, perhaps directly derived from the first, may be very severe, the more so if both were treated together in one room. This was observed in the Hendon milk epidemic. Moreover the milder cases, some from milk infection, give no certain immunity against a recurrence. We cannot hope to protect by inoculation in a disease not clearly self-protective. It is not an unusual thing to see scarlet fever happen at twice, as it were; a child has sore-throat and very little rash, or none, yet the illness is followed by desquamation, and, it may be, with other marked special signs; a year or two after this child is exposed to scarlet fever and has well-marked rash, a short illness, and no desquamation. Reinfection from scarlet fever has recently occurred, to my knowledge, in a child four weeks after a first typical attack, the second attack being the more severe and both followed by desquamation. If the unmodified virus does not confer immunity from a future attack, it is not likely that a modified virus will do so. Two years ago, or more, Dr. Klein shewed that scarlet fever could be conveyed from man to the cow; he has now proved the converse. Quite recently at a meeting of the Royal Society he has shewn that a specific micrococcus from the abraded udder of an infected cow, cultivated in milk or gelatine, produced effects when inoculated under the skin of calves precisely like those resulting from a primary inoculation from the affected cow. Dr. Klein has obtained these organisms during the acute stage of scarlet fever in man; these, when inoculated in calves, after cultivation apart from the living body, reproduce themselves and a disease identical with scarlet fever. There is no proof, in the eager comments a discovery of so much interest has called forth, that we have here the origin of scarlet fever in man; the inference is rather the other way. Still less is it to be supposed in the case of a disease highly infectious from person to person, that we should soon do away with scarlet fever by care as to cows, or drinking no milk that has not been boiled. The real utility of this discovery rather lies in the fact, that, having the microscopic agent of the disease directly under observation, we can ascertain what circumstances are inimical to its activity, and how it can best be destroyed.

Isolation of the sick and convalescent, varying in time and degree with the nature of the disease, and disinfection chiefly personal are our two great means of controlling the spread of infectious fevers. It may be premature to attribute the recent remarkable reduction in our small-pox and scarlet fever epidemics exclusively to our increased means of isolation, but it is well to call attention to the coincidence. The first action of the London Asylum Board Hospitals was to reduce the small-pox mortality in London from 7,912 in 1871 to 113 in 1873, or lower than ever before, and in 1874 and 1875 to 57 and 46; it was only 24 last year. The annual Scarlet Fever mortality in London, for the years 1875 and 1880 exceeded 3,000; in 1884 it was reduced to less than one half this, and for 1885 and 1886, the average is 700, the hospital accommodation for these cases having increased at the same time fourfold. This, and no vague general cause, is to be assigned for the remarkable decrease in scarlet fever in London. While declining in one place, even now the disease is seen to be increasing in another.

THE results obtained in our largest communities towards the control of Scarlet Fever raise two questions. First, can much in the same direction be done for the protection of our villages, schools, and families? Second, how far might what is trustworthy and possible in our large towns fail us at home, or be inapplicable in detail to the smaller units of the community. The room for doubt on this latter point is small, when we consider that the natural history of the disease has been gathered from the collection of individual facts, and by observations made in families; and, that having proved the validity, on a large scale, of the laws thus deduced which govern the spread of Scarlet Fever, we can the more confidently apply them to special cases in limiting infection. As infection is reproduced in the sick, and spreads from them, all effective measures of disinfection should begin at the bed-side, and follow the sick person; consequently the answer to the first question must be largely in the affirmative.

Six weeks is the shortest period in which simple cases of scarlet fever can be considered free from infection. Some careful observations on convalescents as to the period of infection in epidemic disease published more than twelve years ago* by the author, showed that persons recovering from scarlet fever, and apparently well, had imparted the disease to others six weeks, or, with certain complications, for a much longer period, after the commencement of the attack. Abundant proof of this has since accumulated.

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* Transactions of the Epidemiological Society of London, Vol. III., p. 442.

The duration of infectiveness is shorter for small-pox and measles than for scarlet fever; it is shortest after chicken-pox, where after a week's convalescence, or ten days from the full eruption, while the places left by the spots had barely healed, children have safely mixed with others, although another week's seclusion is needed for their own safety. Long care is required for convalescents from all the exanthems; even in the least of them, chicken-pox, dropsical symptoms have appeared, and fatal kidney congestion from exposure to cold, three weeks after the attack. Two simple points serve to distinguish the severer forms of chicken-pox (Varicella) from modified small-pox (Variola); one is, that in the first a spot of eruption may be found on the head or neck with some prominent small glands, on the same day the fever begins; the other is, that allowing for an initial high temperature, the fever continues and mostly increases during the four days of eruption, while that of small-pox occurs two days before the spots appear and falls as they get full.

The infection of whooping cough may persist as long as that of scarlet fever, or be kept up by intercurrent disease; for this is one of those diseases which, unlike small-pox, can be intensified and prolonged by multiplying the number of cases treated together, and by keeping them in one room. Under favourable conditions infection may end in this disease at any time after the first three weeks. When the cough has ceased thus early, some precautions against a relapse or re-appearance of the cough must remain in force for a week or more. Spasmodic cough may recur much later without infection, for, as after scarlet fever the nutrition of the skin may remain altered when infection is over, so after whooping cough some cough may remain, or return and be spasmodic, long after all infective power has ceased.

More young children die of whooping cough than of scarlet fever; but the more serious and fatal consequences of that disease are accidental to the feeble frame of the youngest sufferers from it; they are not the specific and inner constitutional or organic changes such as are set up by scarlet fever, which are capable of reproducing this disease, and from which no age is exempt. The deaths from whooping cough, under five years, often exceed in number those from scarlet fever at all ages; last year they were twice as numerous in London.

To quote from the Supplement to the forty-fifth Report of the Registrar General, p. xiii., after noticing that the mortality from this cause remains unchanged from one decennium to another, the report continues :—"Owing to the very early age at which whooping cough usually occurs, and the consequent impossibility of removing the sick from the healthy, this disease is less amenable than most other zymotic ailments to sanitary control. As was said in speaking of measles and scarlet fever, the mortality from whooping cough in a given decennium is determined mainly by the number of epidemical years that occur within the period; and there was one such year in each of the last decennia, viz., 1866 in the earlier, and 1878 in the later decennium." We may already add 1882 for the next period. Surely much is due from intelligent effort towards minimising the effect of such epidemical recurrences.

The early Spring is always that part of the year when whooping cough is most prevalent and most fatal; at this time, together with croup and laryngitis, it is almost as deadly to young infants as the diarrhœa of the hot season of the year, or the bronchitis of winter. Scarlet fever always extends in the Autumn ; diphtheria mostly in the Winter and Spring; measles has two seasons of greater prevalence, which curiously correspond with children's holiday times. The constant manner in which the autumn fatality from scarlet fever is balanced by the great increase of that from whooping cough in the Spring is a note of difference. Scarlet fever differs also from the diseases above mentioned in not being specially fatal to infants of a year old and under.

As the spread of infection is very often less from want of care during the illness than from ignorance of the natural history of the more common infectious fevers, the following points, to be remembered in dealing with each of them, are given in a tabular form.

Table for each infectious disease :—(i), of the time at which it is likely to show itself after exposure to infection; (ii.), the time after separation from infection, when, if no illness appear, we may conclude the disease has been escaped; (iii.), the time for the rash or other characteristic sign of the illness to appear after the first sickening for it; (iv.), the time from the beginning of the illness to the end of infectiveness :—

Name of Disease.	Usual time of Incubation. (i.)	Possible interval. (ii.)	For rash or other sign. (iii.)	Duration of infectiveness. (iv.)
Small Pox	12 days	15 days	2 to 3 days	3 to 4 weeks
Measles	8 to 12 ,,	18 ,,	3 ,, 4 ,,	3 ,, 4 ,,
Scarlet Fever	2 ,, 5 ,,	8 ,,	2 ,,	6 ,, 8 ,,
Rubella	10 ,, 21 ,,	3 weeks	1 ,, 2 ,,	2 or 3 ,,
Chicken Pox	10 ,, 14 ,,	2½ weeks	1 ,,	a fortnight
Mumps	12 ,, 21 ,,	3 weeks	1 ,, 5 ,,	2 or 3 weeks
Whooping Cough	6 ,, 12 ,,	a fortnight	1 to 3 weeks	6 weeks more or less
Diphtheria	2 ,, 12 ,,	a fortnight	1 to 2 days	6 or 8 weeks
Enteric Fever	5 ,, 20 ,,	a month or more	10 to 12 ,,	4 to 8 weeks or more
Typhus Fever	2 ,, 12 ,,	a fortnight	5 days	3 or 4 weeks
Cholera	2 ,, 5 ,,	a week	sudden	uncertain

It may be noticed in the above table, that, in most cases, the longer the period of incubation, the shorter the duration of infectiveness, The interval in the first and second column has to be reckoned both from the day of separation from the infecting source and also from that of first exposure to it, for infection may have been received at any part of that time. In the case of small-pox if the exposure has not exceeded three days, re-vaccination has a reasonable chance of success; indeed all exposed to this infection, if not thoroughly protected, should be immediately re-vaccinated. To those who have not previously been vaccinated a single exposure may prevent the success of vaccination. In the third column two days or more of uncertainty are seen in the first stage of infectious diseases; these days are infectious. An early guide to a further separation of doubtful cases from others, will be found in some enlargement of the small glands of the neck or behind the ear. In children some of these glands may be very prominent three days before the rash of measles, and the day before the eruption is noticed in rubella, or in chicken-pox; smaller glands down the side of the neck near the windpipe become palpably perceptible before whooping cough, and in croup; their presence alone is not a sign of infectious disease, but with any febrile symptoms they suggest the need of further caution. The fall in body-heat noticeable before the ingress of certain of these diseases can seldom be acted on as a warning from want of continuous skilled observation.

Precautions against the spread of infection on the ingress of scarlet fever are more often successful than in other common communicable fevers, because the onset of the disease is sudden, and is generally so marked as to oblige the sufferer to lie up at once. Two days are required for the distinctive rash, but the sore throat is at once enough to arouse suspicion, and it is not difficult to keep the patient apart from others while the nature of the illness is in doubt; a rash that has been preceded by three or four days of irritable cough with sneezing, is probably measles; a bright spotty rash beginning on the face without marked previous illness, is most likely rubella, or false measles; the fine rash of scarlet fever, first found on the neck or loins, seldom begins on the face and is not in spots, though red points may be seen in the finely diffused and often dusky redness that extends over a large extent of surface from neck, chest, or wrists, and soon becomes general.

Separation when the rash first appears is mostly in time to save the susceptible from scarlet fever. This is not so in measles, where the earliest symptoms convey disease; nor in any other prevalent infection. Diphtheria is communicable in the stage of sore throat, or of malaise preceding the more marked signs of the disease; whooping cough is catching during the first catarrhal symptoms, before their specific character is recognised. These diseases are often spread in their early stages; scarlet fever is not without such risk, but, from the shortness of incubation, it is more under control; after one week of separation, if no symptoms of illness appear, we know the disease is escaped from; the other infectious fevers, to which children are most liable, require nearly a fortnight for their development, and two or three of them sometimes as long as three weeks. In some mild cases of scarlet fever, we may have to wait as long as this before we can be sure we have scarlet fever to deal with, that is, until desquamation removes all doubt as to the nature of the disease.

Besides the danger of infection being carried by those only sickening for an infectious illness, there is the ready conveyance of it by what are called *fomites* to be guarded against; particles given off by the sick readily attach themselves to any surfaces they come into contact with, and may settle from the air of the sick room, even as it escapes into passages or other parts of the house, and so cling to clothing stored near, or be carried in the folds of the dress by those going to and fro. Without these means of conveyance infection, of the kind we are here dealing with, can travel but a short distance out of doors, and soon loses its dangerous powers when exposed to the action of fresh air and light; how this comes about is not clear, neither physical dilution, chemical change, or modified activity of the germ, will alone explain a fact that is, perhaps, more obvious in our crowded streets than in villages where sanitary surroundings are equally observed; country gossips often spread infection; while in London, where next door neighbours hardly know each other, infection seldom passes from house to house, still more rarely across even a narrow street.

An important rule, never to be neglected, follows : this is, while one member of a household is laid up with an infectious illness others of that family should not mix with parties of susceptible children, or be sent to school or to church. This rule should be observed during the progress of a doubtful illness. School managers cannot be too careful in this respect; in day schools when any child is absent from illness, inquiry should be made as to the nature of the ailment, and while the reply is not satisfactory other children from that home should stay away. Still more strictly should the return of a convalescent be guarded against until every precautionary measure has been fully completed; after scarlet fever and diphtheria six weeks must have passed and a certificate should be required from the health authorities that clothes and room have been disinfected. When a series of cases of this kind have occurred in any one school, the best plan is to close it for a time. In any village epidemic among children, school attendance should be suspended for two months.

A former word of advice as to scarlet fever may be quoted, not only important to the convalescents themselves, but which, if largely acted on, would further reduce the spread of the disease and relieve our health resorts from one of their greatest risks : “ Do not seek change of air too “ soon for scarlet fever convalescents ; they are better in their rooms for “ the first three weeks ; they are not only safer in their homes, for the

" next three weeks after that, but they gain strength, just as fast, often
" faster, than if they had been sent off for change of air, to the danger
" of the conveyance used, to the danger of the lodging they go to, and
" to the danger of all with whom they come into contact."*

Whooping cough, as an example of infectious disease not fitted for treatment in hospital, may furnish some hints as to the management of those cases of scarlet fever which cannot conveniently receive hospital treatment. The severity of whooping cough is certainly increased, both by inclemency of season, and by overcrowding. In all likelihood the latter may claim the greatest share in causing the high rate of infantile mortality. To avoid such risk, if we cannot separate the sick infants from the healthy, we can take means to separate healthy infants from the sick. In this as in other diseases of the class, more than in some others, the two room treatment is essential; with varicella, rubella, and even measles (all short self-limited fevers) the sick may be kept in one room with advantage during the strictly specific process; not so with diphtheria nor influenza-catarrh, in both of which children often suffer from strict confinement to one room. A too free or constant use of the steam-kettle does harm both by displacing fresh air and by favouring germs. In common colds and sore throats confinement to the house for considerable periods is often beneficial. It is worth noting that except in specific catarrhs children seldom expel mucus by coughing. Might not an effective isolation often be obtained in villages by boarding out the susceptible members of a family invaded by epidemic disease.

Next, to avoid the chance of aggravating their own illness by going out of doors, and of spreading the disease to others, young children with coughs and colds should be kept at home till they are well, or until the nature of the disease is clear. However useful change of air may be in convalescence from most ailments, nothing is so hurtful in the catarrhal stage of whooping cough as exposure to even moderate wind or chill. In this way more harm than good results from sending children to gasworks, and other places, to inhale the vapours of tar or sulphur. Here again the two room system is required, the one chiefly occupied by the sick must be cleaned, ventilated, and perhaps disinfected while they are placed in a second room, which afterwards has to be purified in its turn before it is used again by the healthy. Intelligent visitors, and in some districts a special nurse, may do much by words of advice during illness, with hints as to pure air, cleanliness, and disinfection, to lessen the danger and stop the spread of disease.

The room set apart for nursing a case of infectious illness, should have a clear capacity of seven hundred cubic feet at least (a room 8 feet high and 10 feet square will give this), so that the air may be continuously renewed without draught or undue lowering of the temperature. A fireplace is essential; even in the summer a lighted fire aids ventilation. Not only should a screen be interposed between the door and the patient, but a smaller screen on a stand, or perhaps only a towel rack, can be so placed as to intercept the free diffusion by coughing, or otherwise, of exhalations from the patient throughout the room. No article of food is to be kept in the room. The air can be thoroughly changed and the windows opened while the child is covered.

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* Social Science Transactions, 1875. Longmans & Co., p. 563.

When two children are treated in the same room for infectious illness, they should occupy separate beds in a large room with 500 cubic feet of space to each; they should be placed some distance apart, or on either side of the fireplace, so that the air current from door or window to the fire may pass between them; the separation thus effected is complete enough—aided by some interposed screen, with careful management and separate service, even when only one room is available—to enable a susceptible child to occupy one side of the room, and to keep in health, while on the other side a child goes through all the stages of an infectious illness. If only a small room is available the patients must be more frequently moved into a second room. Both rooms must be cleared as far as possible, thoroughly cleaned, and alternately purified; sometimes fumigation or a coat of limewash can be applied in the interval, and by some of these means mentioned the infectious period of many diseases has been much shortened; the duration of whooping cough has been reduced to three weeks by filling the room with sulphur fumes for a few hours, the patients being removed till it is cleared and warmed.

Free ventilation with neatness and cleanliness is at the root of all thorough disinfection. The action of any agent absolutely destructive to infective particles is necessarily very limited, both as to the extent and the conditions in which it can be applied; for each one of them in full intensity is also destructive to organized matter or to life. In trusting to germicides of more moderate powers, even those only antiseptic, or to the promoters of chemical change as our aids to disinfection, it is well to employ some whose powers can be judged of by sight or by smell; yet whatever disinfectant of this class is used, at whatever strength, its presence in the air of the room ought not to be so marked as to mask the sense of freshness in the air. It is not only useless to load the air of the sick chamber with any disinfectant, unless free ingress of air is provided, but positively injurious to the patient.

The disinfectants used may be either Carbolic acid, a teaspoonful to a pint of water, or Permanganate of Potash, two grains (equalling a teaspoonful of Condy's fluid) to a pint of water; these are cheap and their use obvious to the senses, for the one is made evident by its disagreeable odour, the other by its well-marked colour. Carbolic acid has the advantage of not discolouring anything in which or to which it is applied, and may be used to cover all refuse for removal from the room, or be ready to receive expectoration, &c. When sprayed about the room, it is not so refreshing as the diluted Condy; this latter may again be diluted by one half and used to purify any articles that have been handled by the patient, or even that have been on or near the bed; thus used, the pink colour is lost or becomes a dull brown as long as any impurities remain, so indicating the need of more of the disinfectant.

Among the more useful disinfectants, Sanitas and Terebene yielding Hydroxyl or peroxide of hydrogen, deserve a high place; they are derivatives from Oil of Turpentine with which the latter is isomeric; both give off a penetrating odour, ozonising the air; they are equally serviceable mixed with water to check infectious emanations from excreta, as for sprinkling about the room, on the screens, clothes, and carpets, or for use in spray; this latter method answers well for freshening the air of the sick room, and sometimes for its directly curative action; as is seen after the use of the Permanganate in sore throats, or of Terebene in coughs. A purer colourless form of Terebene is prepared for internal use; the crude, darker liquid is to be diluted in the same way as Condy for general purposes, or used in small quantities of full strength, where a stronger disinfectant is wanted. A Sanitas Oil is vaporized from boiling water; diluted it affords a cheap form of the ordinary liquid. As one disinfectant should serve as much as possible for all purposes the choice will often fall on Sanitas. A little of either of these weaker fluids can be used directly to the mouth or nose; any expectoration should be immersed in them. These means are to some extent required in common colds, and attacks of diarrhœa; also in consumption, and prolonged or other chronic illness; a five per cent. Carbolic acid solution serves for phthisical sputa. Some embrocations in common use are disinfectant; such are the Camphor and Turpentine liniments of the pharmacopœia, and the oil of amber. Benzoin used internally and the Balsam of Peru used externally have some effect of this kind, the former yields Benzoic Acid, the latter Styrone and Resorcin, all effective germicides. The use of Borax and the still greater potency of Boracic acid are well known.

Stronger disinfectants are sometimes required for special purposes. Benzine, in the carbolic series, is effective; coal-tar naphtha, paraffin or common petroleum oil, is a handy form and can, with any tainted shreds, be completely burnt afterwards out of doors; it is equally potent in destroying the germs of virulent discharges, as against those of the grosser parasites. The Chlorinated Soda of the Pharmacopœia is a strong disinfectant. The strongest are Chlorine and Corrosive Sublimate; the latter is now to be had in a soap, wherein there is less danger of any mistake in its use, and the efficacy is not lost. The Milton Chemical Company, of Glasgow, makes this and other disinfective soaps, such as that with Iodoform or Eucalyptus, that are preferable for some purposes to those made with carbolic acid.

The stronger disinfectants are *germicide*, that is, they kill the germs of disease. This is done either rapidly and absolutely as by fire, more slowly but not less surely by heat from 180° to 240° F., and with varying degress of intensity by chemical agencies; among these must be reckoned the slow combustion of all particles brought back to common earth, also the absorption and purification of foul gases by charcoal. The latter is one type of *Antiseptic*, it holds the poison in its pores and secures its ultimate destruction; this class of antiseptic hastens change, the intended oxidation of the mass or the particle may go on in time to completion, till all traces of either are removed, or only go so far as to purifying the surrounding air. The second class of antiseptic acts rather by delaying change and so keeping the air pure from taint; this is done in two ways, either by a "pickling" action on the offensive medium, so that it can undergo its further destructive changes elsewhere and under conditions not likely to be harmful, or by sterilizing the activity of the germs of disease. Some power of this kind is possessed by all antiseptics; as by Sanitas or Peroxide of Hydrogen, and Permanganate of Potash of the first class, —where even the 'germ of decay' has a part—and, in the two divisions of the second class by common salt, alum, zinc, iron, vinegar, and alcohol, or by lime, the hydrochloric, carbolic, boracic, and salicylic acids, by quinine, and by all the stronger germicides in their weaker forms.

A knowledge of the relative powers of various germicides and antiseptics is needful to the intelligent use of disinfectants; all sure germicides, short of the energy which destroys organic structure, must have an intensity or continuity of action destructive to every kind of life and even to the protoplasm through which it is manifest. Yet these may either be used in full potency without danger, or may be reduced from any degree of activity to merely antiseptic power. In the first case, by removing all living creatures from a room till it is free again, sulphur can be burnt or chlorine evolved sufficient to penetrate and fill the whole space; then by allowing sufficient time, 24 hours or more, disinfection is complete. Again, the protoplasmic poisons, such as mercury, arsenic, or iodine can be strictly under the control of the doctor, and not left with either nurse or attendant in their strongest form. In the second case, by using a smaller proportion of sulphur or chlorine for a shorter time, or to a limited space, a purifying effect short of absolute disinfection, but very useful, can often be obtained.

Experiment has determined for several disinfectants their relative germicide and antiseptic power; of Chlorine, one part to 25,000, is an effective germicide; it is readily obtained from Chloride of lime by adding to it rather more than the same quantity of strong hydrochloric acid previously mixed with water. Next in power comes Corrosive Sublimate, of which 1 to 5,000 is germicide, 1 to 20,000 (1 to 300,000 Koch) is antiseptic; or one grain to ten ounces, half-a-pint, is fully disinfectant, and from a quarter of a grain up to 3 grains to the gallon sufficient for many of the more common purposes. Iodine or bromine have one-tenth of this power, neither are very available. Iodol is better than Iodoform.

Sulphurous acid has a high place as one of the more powerful and most useful disinfectants; it is very volatile and penetrating, is absorbed by cloth and by leather, bleaches vegetable colours, and acts on iron; burning 1lb. of sulphur gives 11·7 cubic feet of this as gas. The gas is very soluble, and is powerful in the disinfection of liquids, it destroys sulphuretted hydrogen, and is not hindered in its actions by albuminous matters. The Pharmacopœial acid, a 5 per cent. aqueous solution, 1 part of gas to 20, is always obtainable, and, when fresh, is both effective and safe; this can be mixed with 20 parts of other matters, and as long as the mixture retains its acidity is effective for certain purposes; it is not merely a deodorizer, but will check the development of 'germs,' while, with free access of air, it rather hastens than retards other changes; with two parts of water this acid is useful, both as a lotion and in the form of a spray; it is a deoxidizing agent, and, therefore, opposed to the next.

Permanganate of Potash ranges with sulphurous acid in efficacy; it acts more by oxidizing and destroying organic matter than as a germicide; sometimes it leaves the bacteria of decay unchecked in their activity, and thus indirectly aids disinfection; at others one part to 5000, or even 15,000 if no albuminous matters are present, will prevent the growth of germs, for, as with chlorine, albuminoids interfere with its full activity; one part to 800 is germicide, so that except in the presence of much animal matter, a strength of two grains to the ounce is fully disinfectant. The Permanganate can be bought at a cost of one penny per ounce; twice its quantity of strong acid, or five times as much Dilute Hydrochloric of the Pharmacopœia, added gradually to it gives rise to ozone, which oxidises organic matter, and so destroys noxious emanations with increased energy: instead of inert Condy placed in remote corners, the salt in a jar moistened with the acid from time to time is effective in refreshing the air of the sick room.

Carbolic acid, eight times less powerful than the above, is about equal in strength to Condy's fluid. If germicide at one per cent. it should be used to this end at about one to twenty; this will serve to disinfect an equal quantity of any matters to be acted on. An ounce or two of Calvert's dark fluid mixed with hot water in the slop-pail to pour down the drains is a good deodorizer; this is useful for stables and out-houses, when no infection has to be dealt with. When Carbolic Acid is used to disinfect excreta a strength of two per cent. is required, or an ounce of Crude Acid to three pints or pounds of medium; hence, unless obtained wholesale in considerable quantity, it is not a very cheap agent. One part to 200 is antiseptic, and in this way, it is highly serviceable for many ordinary purposes, the more so from its special action on the albuminous matters in which infection dwells. The carbolic powders sold as disinfectants and deodorants are to be recommended for the above reasons; their hygienic usefulness is increased by the lime they contain, and also by the Cresylic acid which gives the reddish colour. Crude Carbolic acid of a dark colour, from the presence of crysol, is said to be stronger than the white as a disinfectant, but none of these are certain germicides; they save the air from contamination by averting change in organic matter rather than by favouring oxidation or restoring freshness to the air. Some other disinfectants of this class act on the medium in a different way, yet so as to prevent the multiplication of the germs. Chloride of Zinc (Burnett's fluid), and the Sulphate of Copper and of Iron, are comparable in effect with Carbolic acid. The Perchloride is the more effective iron compound; one per cent. is germicide, and half that strength is antiseptic. Chloride of Zinc can be made at little cost by mixing Calamine, a carbonate of Zinc, with Hydrochloric acid.

Hydrochloric acid is itself an effective germicide; Sulphuric acid is more potent, but less manageable; the former known as Muriatic Acid or Spirit of Salt is very cheap and serviceable; when diluted with nine parts of water it does not act in iron vessels or fittings unless Chloride of Lime is also used; both these are cheap and effective agents, less suitable for town than for country use. The acid further diluted is useful for chamber purposes. A solution of Chloride of Lime, 1 to 40 serves to wet the corpse-cloth after death from Small-Pox or Typhus; two ounces to the gallon, 1 to 80 answers well for the immersion of soiled linen when it is removed; a strength of 5 per cent. in this solution, 1 to 20 or an ounce to a pint, is needed to disinfect tuberculous matter. Sanitary Authorities and Establishments for infectious diseases will find both the Chloride of Lime and the Spirits of Salt among the best and cheapest disinfectants; either can be obtained at less than twopence per pound, the one in cwt. casks, the other in carboys.

Complete disinfection is so often conveniently carried out away from the sick room, either by heating or boiling in an out-house at home, or by stoving or steaming at some public establishment at a distance, that we come to rely more in personal and domestic use upon such antiseptics as arrest infective actions in various slight and efficient ways than upon the stronger disinfectants. The relative potencies already given for these has been estimated from the point at which they kill, or stop the growth of certain low organisms, agents of decay, closely allied to germs of disease, and, in case of one microscopic rod or *bacillus*, the actual germ of a disease—splenic fever—in animals; this germ produces 'spores' out of the body, very resistant to heat and difficult to destroy; none of the microzymes hitherto detected in the course of any of the infectious diseases of man are known to produce spores. The bacillus in question, owing to its power of resisting many antiseptic agents has been taken as the test for germicide action; it only produces spores when it leaves the blood for sites with more available oxygen, as in cultivations.

With some differences for certain germs the results of experiment have been remarkably uniform; thus the increase of every species of *microphyte*, or microbe, as these minute forms of life have been called, is stopped by 0·5 of sulphate of iron, or one part to 200, but none of them are checked by 0.25 or half that proportion; moreover mercuric chloride at 0.003, and iodine at 0.025 were effective or not, according to the time of exposure. In all experiments with disinfectants, their intimate access to every part of the infected material, and duration of the contact are necessary to success; the time of exposure is often of the very essence of the question.*

On the lowest organisms and especially upon the unorganised ferments, however, a great difference of action is observed; *i.e.* the activity of the latter is arrested by some weak germicides, but they are not affected by some of the more potent, nor by so strong a protoplasmic poison as Mercuric Chloride. Alcohol acts on the septic *micrococcus*, and controls infective suppuration; Boracic acid on the *bacterium* of putrification. The anti-ferments are feeble germicides, and except in the case of the yeast plant, they stop fermentation without destroying its agents. They are more to be used as remedies, than as disinfectants.

But, all diseases are not owing to germs, most of the infective fevers in all probability are due to a protoplasmic particle of this kind, but whether due directly to their growth and increase, or to some outcome of their activity is not thoroughly ascertained. However fever is excited or carried on, it is evident that without germs that can be transported to another home, and not only excite a similar action there but be multiplied in the process, the disease can hardly be called infectious. Snake poison is infective, but it does not set up an infectious disease; it is not a chemical, but an albuminoid or proteid body;† not an independent organism, not a living entity, but the product of cell-life, a formed material, no longer even protoplasmic.

The unorganized ferments are also proteid particles, many of them concerned in vital processes, as in those of digestion, others in the causation of disease; though destroyed by a heat of 160° F., they are not acted on by some germicides, and have this special resistance to the action of others, that, while inert in their presence, no sooner is the anti-ferment removed than the fermentive power reappears.

Boracic and Salicylic acids, are of this latter class; both, germicide at or below 1 to 200, are antiseptic at 1 per 1,000, and under some circumstances to double that extent; the latter at 1 to 15,000 has kept a solution of grape sugar from fermenting. This acid combined as Salicylate of soda has no antiseptic power, unless under conditions where the acid is set free; the bi-borate of soda retains near upon half the power of the uncombined Boracic acid. Formic and Lactic acids have similar activity. These antiseptics are powerful anti-putrescents, yet in such strong solutions as 1 to 25 are not always disinfectant; they, with other germicides as carbolic acid in spray or some preparation of acetic acid, without destroying the germ, impede its developement by uniting with the substances indispensable to germ growth; they also act by preventing germs being set free during decomposition. Chromic acid 1 to 8 is potent.

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* In Dr. BUCHANAN'S most valuable Reports to the Local Government Board (14th, p. 208); the degree of dilution at which Sulphuric Acid prevents the growth of *Bacillus Anthracis* is given as 1 to 1,800; at 1 to 600 it kills them in two hours of exposure; at 1 to 500 in ten minutes; at one per cent. the spores are inert after a week. An acid of the carbolic series was germicide at 0.16 or 1 to 600 in an albuminous medium, yet in the absence of nitrogen 0.05 of this acid, 1 to 2,000 killed the *bacillus*, and killed it in a shorter time, p. 186. I am also indebted to Dr. G. M. STERNBERG, of the United States Army, and National Board of Health, for many germicide values; he says, "a re-agent with little or no power of this kind may be capable of *restricting the development* of pathogenic organisms, and thus limiting their power for mischief." See American Journal of the Medical Sciences, April, 1883, p. 333.

† R. H. Wolfenden, Journal of Physiology, Vol. VII. 327-364.

The anti-febrile power of quinine is partly due to some resistance of this kind imparted to the tissues, as by restraining the absorptive power and motility of the white blood corpuscle; it is also seen directly to check the increase of germs by some special action on them; Iron, alum, tannin, and zinc, act in one or both of these ways. A similar power, long known to reside in the volatile oils, has of late been largely utilised in Thymol and Menthol, the derivative camphors of two of them, and in the oil of Eucalyptus from the leaves of the Australian Blue Gum Tree. The latter also has an ozonising effect on the air while it oxidizes; it is not an irritant even to tender surfaces; an ointment of one part to five is in use. Boracic acid, a weaker germicide, is used in the same way; this acid is soluble in 25 parts of water. Salicylic acid disolves in 760 parts of water, or in 120 parts of olive oil; an ointment of 1 to 27 is ordered in the pharmacopœia; by mixing an equal part of borax with this acid, the solubility is increased to 1 in 24, so that 20 grains can be disolved in an ounce of water, and its germicide power of 1 to 200 maintained.

By heating nine parts of Salicylic Acid with ten of Carbolic Acid oxygen is set free and a new antiseptic, Salol, with an odour like that of 'Sanitas' is developed; this scent is more marked if one part of Eucalyptus oil be added. As this compound is soluble in alkalis and, to a sufficient extent, in fatty matters it has been incorporated into a useful sanitary soap. When used with oil or vaseline for inunction, the proportions should be eight or ten grains of this compound to an ounce of the medium; a drachm heated with half an ounce of lard and mixed with three parts of hot vaseline makes a strong and effective ointment. Vaseline takes up 5 per cent. of Carbolic Acid. The use of adding lard or other fatty matter to Vaseline for innuction is that it remains longer on the surface, and aids the diffusion of the Carbolic Acid. Salicylic Acid readily disolves in lard, and this mixed with Vaseline, so that 5 or 10 grains of the acid are contained in each ounce of the Carbolated Pommade, secures better penetration into the epidermic scales, and the carbolic odour is lost. Salicylic soap checks and removes disagreeable perspiration.

It is a good rule to keep to one disinfectant, and to bear in mind the way in which it acts; the above exceptions are allowable, but it is to be remembered that Chlorine cannot be used with Peroxide of Hydrogen, nor Carbolic acid with Sulphur or Condy's fluid; the latter is decolorized by Carbolic acid, and rendered inert. One important exception to the rule is that, when antiseptics are trusted to in the sick room, the more effective means of disinfection must not be forgotten; in Enteric fever (typhoid), and in Cholera, beyond removing all excreta in diluted mineral acid, as before recommended, some further means are required to disinfect; any increase of germs is prevented, while the medium retains its acidity, but this is soon lost if carried by water along the sewers; when not got rid of in this way, the addition of chloride of lime would destroy infection, and in country places this might be insured by covering with earth in a trench, when this cannot be done, a little quicklime might be added; slaked lime with sulphate of iron or copperas would precipitate solid matters, and then using permanganate of potash would have full effect on the effluent; any permanganic acid set free by the mineral acid, would act further as a disinfectant. Corrosive Sublimate is most effective.

Desiccation, which arrests the development of all germs, has been ingeniously applied to this purpose, by Astrop's procees (*Lancet*, vol. i, 1887, p. 287). Cold checks the activity of germs, but does not destroy them; excess of oxygen, and exposure to light as recently shewn by M. Arloing stops their growth; warmth and moisture favour their increase. All germ-growth implies rapid interchanges with the environment, where oxygen, some nitrogen, and much water must be present. The microphytes of some of our common infections (*e.g.*, Vaccinia) when cultivated out of the body, and supplied with sufficient nitrogen and abundant oxygen, increase in size but lose their infective power. This agrees with Pasteur's demonstration, that a full supply of oxygen favoured the growth of the yeast plant, but lessened the activity of fermentation; one part of ferment in a deep vat destroyed one hundred parts of sugar, but only five parts in the shallow vat with freer access of oxygen. Most diseases are less active in fresh air, some may even pass unrecognised under milder forms. All germs are killed sooner after removing any of the elements on which they grow or increase.

Water and aqueous vapour, while giving activity to germ life, are also the means of bringing germicides into play, and of securing their full effect; germ-spores that resist for some time the hot-air chamber are soon reached when steam is admitted even in small quantity. A little water evaporated while sulphor is burnt in an empty closed room favours the action of the sulphurous acid, probably by aiding its penetration; a considerable quantity of water should be evaporated when chlorine is to be generated in sufficient amount to thoroughly purify a disused room; which of these gases is best for this purpose must depend on the quantity present and the length of time allowed for their action. The proportion of sulphur to be used for a room of given size is more definately known than the volume of chlorine required, the only rule for the latter is that it must be sufficient to render the air irrespirable. Chlorine as an air-disinfectant has a much wider range of utility and power. In the 13th Annual Report of the Local Government Board, 1884, p. 131, we see that a healthy animal can be placed in the same compartment with a diseased one, even for so long a time as six hours, for five successive days, without being infected, provided the place remained well fumigated with chlorine gas up to marked pungency, twice during the six hours being sufficient. Sulphurous acid gas at the strength at which it could be used was only successful against milder forms of disease.

The disinfection of the clothes worn by every one brought near to sources of infection, should be followed by full exposure to air and light before they are either worn or put away. Re-packing should be done out of doors, or some of the atmosphere of the infected house is packed up and taken away with the clothes. The necessity for this precaution is specially great in scarlet fever. From the Reports quoted above (13th p. 61), Dr. Page relates how in this disease the assistant mistress of a board school, closed because child after child, none of them resident, had scarlet fever, though not herself ill, carried infection with her to an isolated farm-house and started the disease within a week of her arrival. Dr. Murchison mentioned before the Clinical Society in 1878, an instance of scarlet fever breaking out on board ship in the Red Sea, seven weeks after leaving Sydney. Three weeks before embarkation in April, a family on board had resided with friends in Queensland who had scarlet fever; all went well at starting, but the light clothing they had worn in the semi-tropical heat of Queensland had been packed up there for the voyage, and the boxes had not been opened until after leaving Aden and reaching the terrible summer heat of the Red Sea, when it was unpacked and again called into use. It was in this family that the two first cases occurred, three months after they left the infected house in Queensland. Of 147 passengers and 40 children, 30 cases of scarlet fever appeared in four days before reaching Suez.

The general principles of disinfection only will be stated with hints as to their applicability to scarlet fever; as where any one is under treatment for this disease much detail must be left in the hands of the doctor and nurse. With a sufficiently airy room either a little apart from those used by other inmates, or at the top of the house with an adjacent room or landing at the disposal of the nurse, the risk to others in the house, except to the young, is not great. In removing all unnecessary furniture and clothes from the sick room, none in use since the sick person occupied it should be packed away without first having been well cleaned and exposed to heat. A linen cloth or screen should be fixed over the doorway, on which some simple disinfectant should be sprinkled. Sanitas answers equally well for these purposes, also as a spray in the room, and for use in other ways. Sponging parts of the skin with the diluted permanganate, or with a little aromatic vinegar, or the use of Sanitas or of Eucalyptus Soap is pleasant to the patient. Carbolic soap is less effective as a disinfectant than that containing Eucalyptus and Iodoform. Lubricating the whole surface of the body, as is now a very general practice, certainly restricts the dissemination of infectious particles. Carbolic oil (1 to 40) or the Eucalyptus or Boracic ointment during convalescence can be used after detergent baths ; either of these, or a hair-wash of Acetic acid two parts, with one each of Spirit and of Glycerine to two of Rose water, can be used to the head after it has been washed.

At first a little cold cream or vaseline only should be applied to the skin after sponging. Vaseline is specially suited for this purpose, it keeps moist for eight hours or more and is not readily absorbed ; this is of great advantage in the use of carbolic or salicylic acid, or of the two combined in the manner before mentioned, as their effect is thus properly restricted to the skin-dust during convalescence. In young children, and where the skin is tender, all irritants should be avoided. Olive oil will take up one part to nine of Carbolic Acid, even at this strength, an ounce to half-a-pint of oil, it is not a reliable disinfectant, and there is fear of the acid being absorbed and acting injuriously on the kidneys, a serious objection to the use of even the weaker carbolic oil in many cases.

The topical use of the milder disinfectants in the daily toilette is advantageous throughout the illness ; after the first remission or on the subsidence of the more marked symptoms they should be carefully applied, especially to the hair, in connection with a warm bath and change of clothes. To freshen the air of the sick room, Sulphurous Acid, the gas in aqueous solution, one part to two of water, or a solution of Peroxide of Hydrogen in similar form can be used in spray ; the latter gas has no odour. This, with ether, called Ozonic Ether, of thirty volumes strength, three times that of the liquid, may be sprinkled about the room, and in the hair, or on to a handkerchief ; it has been used as a gargle with two parts of Glycerine, and thirty parts of water. A bad throat is better sprayed with weak Condy, or the diluted Sulphurous Acid ; or cleared with Chlorinated Soda solution, one part to ten of water ; gargling is less effective and often painful. A solution of Chlorinated Soda mixed with two parts of water is often required in the room as a stronger disinfectant for soiled lint or rag that cannot be immediately burned, or for use to bedding or carpet without injuring the fabric as the chlorinated lime is apt to do. All linen clothes after use should be removed from the room and immersed in water with some disinfectant.

Chlorine seems specially suited to counteract scarlet fever infection ; one or two dishes with a little moist Choride of lime set about the room will, by means of carbonic acid in the air, give off enough Euchlorine to deodorize without any irritating effect on the inmates ; the same gas can also be liberated slowly in the room by placing on the top of a shelf, not too near the patient, a wide mouthed bottle in which ten grains of crystals of chlorate of potash, and half a teaspoonful of strong hydrochloric acid have been placed ; or, more of the crystals can be used and the acid renewed from time to time.

It is not necessary that these vapours should be of a strength to kill the germs of disease; if they prevent contamination of, or restore the oxygen to the air they are of service. Many antiseptic or disinfecting agents are not really germicide or absolutely destructive to all infection; some do little more than deodorize; others arrest the septic power; some have their use in safely conveying away the agents of disease from the room or house. In this way clothes can be taken to the laundry, but must not mix with others, until they have undergone the requisite boiling for half an hour or more; this really destroys all infective power.*

Very often it would be possible, in the course of the disease, to remove the patient to a well-aired room for a whole day, and thoroughly purify the sick room with sulphur vapour. Spread open the bedding, clothes, playthings, &c., close the windows, chimney or other apertures, and burn, in the centre of the room, 1 lb. of yellow Sulphur moistened with methylated spirit, with precautions for its safe and complete combustion. After five or six hours the room can be entered and cleansed ready for use again by night. The room occupied by the convalescents during the day can then be similarly fumigated, a pound of sulphur will suffice for this purpose. Either allow half a pound of sulphur for each person occupying the room or a pound per 1000 cubic feet. A larger quantity is needed, and a much longer time of exposure, for full disinfection.

Thorough and complete disinfection is only effected by heat; that of boiling water if applied long enough is sufficient. Steam applied under moderate pressure for five minutes destroys the germs of most diseases. Boiling the linen clothes for half an hour with a little soap and soda or common salt disinfects thoroughly, if so managed that the heat reaches to all parts; any stained linen after the use of the strong disinfectant should be steeped and rinsed in cold water to remove the stain before boiling, as by steaming or long boiling the stain is fixed. Woollen clothes require dry heat, as hot water shrinks flannel and woollen textures; felt hats, shoes, and leather goods are spoilt by steam or by wetting, these stand dry heat well; mattresses should be unpicked before exposure to heat and re-made afterwards to ensure disinfection. Some degree of safety is obtained by placing articles of this kind before the fire, or in an oven, after they have been cleaned. Any heat over 240° is injurious to these materials, a heat of 250° scorches flannel.

After a sick-room is no longer occupied, complete disinfection should be brought about by means of the full use of sulphur fumes, the sulphurous acid liberated by burning sulphur, in sufficient volume, may be relied on to reach and act upon all that is most conveniently left in the room. To effect this, the bed should be uncovered and raised from the frame, the brass or iron work here and elsewhere, as on doors, windows, &c., is to be protected by a coat of grease, drawers and cupboards are to be set open, the windows and chimneys closed; then a pound or more of sulphur, according to the size of the room, in a perforated earthern or iron pan, is to be moistened with methylated spirit and placed for security, during combustion, over a tub of water in the middle of the room, or in more than one place, if the room be a large one. When this is lighted the room is to be closed and left so for more than twenty-four hours; then means can be taken for dissipating the sulphur fumes, and the room and everything in it must be well cleaned and ventilated.

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* We are indebted to DR. JAMES B. RUSSELL, of Glasgow, for establishing this fact on a sufficiently large scale. DR. JAMES A. RUSSELL, of Edinburgh, in Quain's *Dictionary of Medicine*, gives a very complete article on Disinfection.

A small room can be very conveniently disinfected after short occupancy by igniting Bisulphide of Carbon, by means of a cotton wick placed in the half-pint bottle the liquid is sent in, and letting it burn out while standing in a good sized vessel of water; over the flame water can be evaporated at the same time from a shallow dish. This is a convenient way of disinfecting any private carriage used for the conveyance of the sick. It is more effective than the pan of Chloride of Lime moistened with dilute hydrochloric Acid as generally used for this purpose.

This fumigation, after the end of the disease, should be superintended by the Sanitary Authority of the district, to whom notification of all infectious illness ought to be made, at the beginning of the illness as well as at the end. In this way much assistance is often obtained, and especially in the complete purification of bedding, and intractable material, either in the steam chamber kept for this purpose, or by removal under all proper precaution to where thorough stoving can be done. Some colored fabrics are better disinfected by stoving, than by sulphur fumes which bleach. After the use of sulphur a thorough cleaning and a general lime-washing of ceiling, walls, and passages, should be carried out. In re-painting and re-papering walls, cupboards, and recesses, no shred of old paper must be allowed to remain.

Disinfectants may be classed, excluding those destructive to all forms of life, such as fire and nitrous fumes, into *direct* and *mediate* disinfectants; the former are again divided into—1 local, used to substances apart from the living body, or—2, surface, applied to the body; the latter into—3, those acting through the air, and—4 through the medium of water. Under division 1, are Lime, Charcoal, Chloralum, Carbolic Powders—Calvert's or McDougall's. Waste Chlorides from Chlorine works should be cheap, and would be very effective if not used with Carbolic compounds. Division 2, includes Nitric Acid, Nitrate of Silver, Iodoform, Ferric Chloride, Alum, Acetic, Carbolic, Chromic, Boracic and Salicylic Acids, Eucalyptus Oil, Thymol; in division 3, are Chlorine, Sulphurous Acid Gas, Peroxide of Hydrogen, Sanitas and Terebene; in division 4, Hydrochloric Acid, Mercuric Chloride, Burnett's fluid (Zinc Chloride), Condy's fluid (permanganates), the Sulphates of Iron and of Copper, Sulphurous Acid, and Chloride of Lime, find a place.

With reference to the patients welfare, cleanliness and fresh air are the first essentials; common soap and water, careful attention, and good ventilation, are needed in the room to keep the air from taint. Terebene or Sanitas have an advantage over Condy and Carbolic Acid, that both the latter interfere with the efficacy of chlorine and sulphur in further disinfection, moreover they counteract each other and should never be used together. The liquid Sulphurous Acid or diluted Hydrochloric Acid are the best of the stronger disinfectants to add to the water used for covering the excretions, or for removing linen from the room, and even for these purposes either of the first mentioned preparations will mostly suffice.

But little variation is required in the management of the different diseases that have been enumerated. In all of them, isolation of the sick is the first object, and if this is not done by removal to hospital the same end is to be attained as completely as possible at home. In Small-pox the attendant should be known to be protected from liability to this infection; no one who has not previously been re-vaccinated should come into the sick room until four days after this operation has been performed, and it is seen to be successful; any matter from the spots has to be steeped in the strongest disinfectant, or at once burned; the crusts separating during convalescence should be burned.

Scarlet fever patients must be nursed by those who are protected through a previous attack; both surface and air disinfectants are required; chlorine is advantageous. Convalescents must observe six weeks quarantine whether desquamating or not.

Diphtheria requires most of the precautions given for scarlet fever; the attendants should not be selected from the young, nor should they remain continuously in the sick room; all secretions from the throat should be destroyed, and some surface antiseptics either as spray, liquid, linctus, or powder, used to the throat; in the last form, Magnesian Sulphite is useful.

Measles and Whooping Cough are aggravated by insanitary surroundings; the air, the surface of the body, and the clothes require disinfectants; chlorine is objectionable. Convalescents after measles should be kept four weeks, and after whooping cough six or eight weeks from mixing with the young and susceptible.

Mumps and Chicken-pox require a disinfectant mouth wash, weak Condy is best, as well as other precautions.

Enteric fever needs moderate air disinfection and most careful and efficient water disinfection for the excreta up to complete convalescence. In Typhus fever a free air supply, absolute cleanliness, some aerial freshening, and complete disinfection of the clothes, if they were not at once destroyed, are required. The attendants should be selected from the younger nurses, as the persons protected by a previous attack are few, and older persons are most liable to severe attacks.

In Cholera, disinfect the excreta as quickly and thoroughly as possible; this is more effective if the medium is made acid. The attendants should take none of their meals in the sick room, and be as attentive to their own ablutions as to those of the patient.

The germs of all these diseases excepting cholera, enteric fever, scarlet fever, and possibly of diphtheria, multiply exclusively in the bodies of the sick; they get into the air, water, food, clothing, and bedding near the patient, to be carried forth or remain in the room to infect others either quickly or after some length of time. When the conditions of their existence are widely known and the means at our disposal for dealing with them more widely understood, it is to be hoped that a marked diminution of these "preventable" diseases may be secured. Even the less fatal of them will then receive the care necessary to their restriction, for much discomfort, much inconvenience, hindrance to education, arrested development, and often permanent injury to health and activity, result from neglect of the minor infectious diseases.

One attack of any of the truly infective diseases, the germs of which increase only in the living body, is usually protective against the recurrence of another. This is fairly constant for Measles, Typhus, and Hydrophobia, nearly so for Small-pox, Varicella, Rubella, Mumps, and Whooping Cough. It is the rule in Scarlet fever, and is not exceptional in Diphtheria. Cholera may recur, and is so far like Ague and Influenza; but in this disease one attack predisposes to another, instead of conferring any immunity as Enteric fever certainly does. The latter may proceed from a micrococcus allied to that of Pneumonia, and Erysipelas, or to a *bacillus* like that of Tuberculosis or Struma. In the other diseases dealt with, two kinds of germs must be concerned, one re-produced only in the bodies of the sick, the disease being self-protective; the other capable of multiplication outside the body, resulting in a disease liable to recur. The germs of Ague, and Remittent or Malarial fever are certainly of the latter type; and probably those of Influenza and Cholera.

The various germs associated with the infective diseases are referred to the lower forms of vegetable life both from their morphological characters, as accepted by skilled observers, and from dynamic considerations. Animals convert simple elements into the more complex, as carbon into carbonic acid, setting free energy—some of it as heat. Plants reduce the complex to more simple elements, the unstable to more stable compounds. The lowest "germs" do this: with the forms of life they are agents of decay; their activity is increased by the heat from condensing vapour or of decomposition, for their energy is evolved from the medium they destroy. Death, or the shaded side of the globe of change, is another mode of life; when the higher and controlling vital power fails, the lower comes into play, and we do but substitute chemical for vital processes in disinfection.

The courtesy of Dr. George M. Sternberg, Chairman of Committee, has supplied me with the Report of the American Public Health Association on Disinfectants, and also with a copy of his Prize Essay, on Disinfection, published last year. The utility of Chloride of Lime and the efficacy of Mercuric Chloride are fully recognised in both works. To render these agents more readily available, standard solutions are recommended to be kept in constant readiness for use. That of Chloride of Lime, 1 to 20, eight ounces to a gallon of water, is very handy; it can be diluted for use by one-half, or more when no organic matter has to be dealt with. This solution, or one of Chlorinated Soda 2 per cent., serves for steeping infected linen. Fluorine compounds are most potent disinfectants. The Sodium Fluosilicate as used by Mr. W. Thomson, is odourless and safe; it surpasses Mercuric Chloride in power, and is not poisonous. The power of the Bichloride of Mercury may be utilised while its dangers are guarded against, either by giving to it the red colour of Permanganate of Potash, as in the Standard Solution No. 2 in the Report, p. 131 where two drachms of each salt are dissolved in a gallon of water, or by the strong blue colour of copperas as in Solution No. 3, to be issued in special bottle:—Bichloride of Mercury 4 ounces, Sulphate of Copper 1 pound, Water 1 gallon.

This is further diluted with eighty parts of water, two ounces to a gallon, for the immersion of infected linen or clothes for two hours before they go to the laundry. When thus diluted, the fear of accidental poisoning is reduced to a minimum. It cannot be used in metallic pans, for the Mercury is precipitated by contact with copper, lead and tin; leaden pipes are acted on injuriously by it and rendered brittle. When clothes cannot be immediately disinfected by boiling, immersion for four hours in this solution is efficacious, and equal in effect to a 2 per cent. solution of Chlorinated Lime or Soda. When circumstances make it expedient to use the more potent and odourless disinfectant, the solution as above, or coloured with indigo or by other means, offers an additional safeguard against the dangers, not greater than for Carbolic Acid, which may be incidental to its use. Either of these solutions diluted may be used on the moist cloth with which any surfaces exposed to dust in the sick room should be wiped. Wet sawdust impregnated with Sanitas Oil can be used in clearing the floor, with the object of preventing any dry dust being raised and diffused.

Thoroughly to disinfect a vacant room, experiments shew that 3 lbs. of Sulphur should be burnt for every 1,000 cubic feet of space; it is impossible so to close all apertures as to keep vapour enough in the room from 1 lb. of Sulphur for the requisite time, 12 hours, to be efficient. All fumigations are injurious to the sick, and it is useless to burn Tar, Turpentine, and scented things in the room; Carbolic Acid loses its properties on being vapourized by heat, and burns to inert particles of Carbon.

NOTES

ON THE

HEALTH OF CHILDREN.

[*Reprinted from* "Our Homes," *with some alterations. By permission of* Messrs. CASSELL.]

THE HEALTH OF CHILDREN.

A FIRST series of observations on the variations of body-heat in infants and children, made, as a foundation for the study of the diseases of childhood, mostly in the ten years before 1865, has long been out of print. Further enquiries of the same kind led to some hygienic comments recently embodied in "Health in the Nursery," a contribution to the volume entitled, "Our Homes, and how to make them Healthy," published by Messrs. Cassell; their kind permission enables me to add many extracts from this later publication to the reprint of my earlier paper. My best thanks are also due to Messrs. Cassell, for the opportunity of including among more strictly medical essays the diagrams prepared by them at my suggestion, from vol. xxxiii. of *The New York Medical Journal*, of the normal rate and ratio of growth in the first year of infancy. These illustrate the way in which our first start in life is made; they need to be brought to the more special notice of professional readers, as our medical text books give no standard by which healthy infantile development can be judged by, and it is but quite lately that the very constant physiological loss of weight in the first week of independent existence has been noticed in our medical journals as well established.

Among the more recently acquired facts bearing on the subject in hand are the determinations, by Dr. Percy Frankland, of the relative proportion of germs found in the air under different circumstances. These were brought before the Society of Arts, March 22nd, 1887. Fewer germs of decay are found in country air than in town air; fewer in winter than in summer. In January, about 600 cubic inches of air passed through a glass tube lined with prepared gelatine produced four colonies of germ centres, while in August 105 were obtained in the same way. On May 19th, 1886, the air on Primrose Hill gave 9 colonies, at the foot 19 were obtained; the number from air above the dome of St.

Paul's was 11, from the churchyard below it was 70. In Exhibition Road, when crowded, on June 8th, 1886, the air yielded 554 colonies. Few germs are found in the air of rooms when very still and quiet, but many if dust arises. From a room tenanted and closed dust should be removed in a moist state. In an occupied room germs are not the only spoilers of the air; the carbonic acid given off by respiration is almost equalled by the organic emanations constantly going on. It is most important for children, whose resistance to the encroachment of adverse influences is less than in adults, to have ready access to fresh air in open spaces. The ill effects of any leakage from gas pipes on health, set forth by Dr. Richardson in "Our Homes," has since received further elucidation from Dr. Corfield.

SANITARY defects in dwellings are most plainly shown in spoiling the health of children; the young soonest suffer from bad air, noxious vapours, damp, dust, and want of cleanliness. Into houses where the children are lively and well we may be sure no sewer-gas enters; this may not be the particular cause of illness where children are sickly, but some violation of sanitary law will be found that checks healthy development. Nowhere is the right of health to be more vigorously maintained, or more jealously guarded, than in the nursery; for while the neglect of sanitation here saps the cheerfulness of childhood, and ruins the fair prospect of youth, nowhere is attention to sanitary law more promptly and permanently rewarded than in the normal evolution of all we hope for in the young. The healthy condition of the child, and the means of ascertaining it, will be set forth as the measure of how far the children's rooms at home and at school are made healthy.

The details of nursery fittings must vary extremely in the different grades of society, while many of the same details of nursery management can be commonly carried out; the principles to be kept in view are the same in all stations of life, and may often be as well observed in the poorest as in the richest dwellings. No amount of grandeur will keep mansions free from noxious gases; the most costly chamber soon becomes unhealthy if constantly occupied. Luxury can add nothing to the pure milk required by infants; when this has to be supplemented, the same care must be taken that the added food should be fresh and uncontaminated, a care required earlier and oftener among the rich than among the poor. Arrest of nutrition, actual starvation, from dieting an infant on what it cannot assimilate, is still frequent among all classes. Danger from placing a baby in the horizontal position the moment it has finished a full meal, or of covering its face completely during sleep, may happen on a bed of down. Sleep may be prevented by tight bands, or miserable swathes, in a satin bassinette or gilded cradle. Warmth can be kept by plain clothes or loose wraps, while all the evils of chill may be suffered in the embroidered dress of fashion.

> " If onely to go warme were gorgeous
> Why Nature needs not what thou gorgeous wear'st,
> Which scarcely keepes thee warme."
> *King Lear*, Act II., sc. 4.

Children are the better for frequent changes of room ; they have to spend most of their time in the house; they require short intervals between their meals, with quick transitions from play to rest. The meals should be taken where there is no litter of toys ; a quiet room is needed both for work and sleep. Means of getting change of air, and of taking exercise within-doors or under cover, are essential. Children thrive best with free and frequent access to the outer air ; no attempt should be made to render any suite of apartments for the young independent of this, and any arrangement that makes it difficult for children to get out of doors is to be avoided. The infant schools for the poor in large towns are distinctly useful in bringing young children, from the rooms they occupy at home, into the fresh air twice a day. All schoolrooms are now improved.

Home life to the younger members of a family and to the gentler sex means that by far the largest part of every day must be spent indoors, and half of it—at least for the very young—in the bed room. No attempt should ever be made to rear children in a single room. The necessity of providing a full supply of pure and fresh air in youth, when change and growth are most active, is obvious. Whatever has been said of the general requirements of a house, it is in the nursery where all that is most essential to health and comfort should be most perfectly represented. The active man, whose duties for the greater part of the day call him abroad, sooner forgets his fatigue, and has his strength for renewed activity more thoroughly restored, where a healthy home awaits his return. For those who have to spend most of their time within, from duty or necessity, the greatest care in all the details of a wholesome dwelling are most wanted. The strong man after free respiration out of doors may pass through foul or damp air in the basement of the house with the inner breath of his capacious chest untouched ; he may sit in a close hot parlour without enervation, or sleep in a chilled bedroom without his vigorous circulation being seriously depressed. Not so those who stay at home ; from these evils even the strong would suffer ; delicate women, susceptible youth, tender childhood suffer most. The mature and robust bear cold well, so that the air be dry and pure ; the young must have warmth. Another necessity for those much indoors is light. No room can be healthy however well calculated for its inmates, unless, in addition to the requisite air-space, the air it contains is being constantly renewed ; this is ventilation. Most important of all those requirements is cleanliness.

The cares exercised for a healthy person kept in bed by an accident, or for an invalid confined to the house or room for a season, set forth what infants always need. At first the comfort of the bed room is everything ; the night is not all rest, and part of the day has to be shaded into night. Soon it becomes possible to change the room for a time ; then, open the windows, brush the floor, dust and clean the chamber, so as to replenish it with pure air, and remove the myriad particles ever spoiling the oxygen of its freshness. While the room is still occupied much of this can be done; done quickly, that the temperature be not lowered unduly, and so done as not to expose the patient to chill. The air of the room must be changed, to some extent, both in the day and at night ; a partly-open door or window only admits fresh air to some part of the room, but if not to the part of the room occupied, or even to the very face of the occupant, the breath is breathed over again, and effete matters or injurious emanations mingle with the vital air. A special atmosphere, readily vitiated, forms around a cot or within the curtains of a bed. The lowest layers of air about or under a bed, or by the cot near it, become soonest impure ; respired vapour is heavy, and contains moisture, with numerous particles that settle in it, contaminating the lower stratum of air even when nothing is left near the bed that should be removed.

Young children bear cold badly. In removing them to a separate room means must be taken to secure moderate warmth. Sudden changes of temperature are to be avoided, and special care must be taken against any long continuance in a low temperature. A small child soon loses heat, and is most depressed by such loss during sleep. In many cases of illness or weakness a fall of ten degrees in the child's room may be of the utmost injury. Besides proper means of warming children's rooms, and care to see that windows are closed in cold weather after the air of the room is changed, the chamber thermometer, an indispensable requisite for the nursery, must always be consulted. The bath thermometer, with its metal trough and high index, often extending to the boiling-point at 212°, does not answer the purpose ; and, moreover, should always be kept in the bath-room to be ready for use in any bath, whether cold, tepid, or hot; but a cheaper instrument, mounted on wood, with more open register, the degrees from 50 to 70 conspicuously marked, should be so placed in any room that the variations can easily be noted.

The temperature of the room is a fair guide for the cold and tepid bath. It is well to add a little warm water to the children's bath, or to wash them in warm or tepid water and sponge over the surface with water of the temperature of the room, just before drying with a warm towel and gentle friction. The ablution of young infants must always be in warm water about 90°, or raised as much above the temperature of the room as the nurse may judge necessary; here the sensation of the hand and arm may generally be trusted, but the correctness of the estimate should now and then be tested by a thermometer. A warm, or hot bath, for the complete immersion of a child, should never be given without careful use of an accurate thermometer. A temperature of 98° is quite enough to begin with, and even then the child should be immersed gradually and gently. For the relief of pain a heat of 99° or 100° may be required; if so, the child should be removed on to a warm flannel while more hot water is added, and the exact thermometric degree obtained. No hurry is ever allowable in preparing a hot bath. Many of the emergencies for which a hot bath is recommended would be more safely managed with merely a warm or tepid bath. Time is also required for consideration as to whether a hot bath is appropriate; it is seldom proper during febrile symptoms of any kind; elevating the temperature of the blood above the normal is a stimulus to be used with caution; warmth just sufficient to dilate the surface circulation, while still below the body-heat, cools the blood as it comes by successive pulsations in contact with the surrounding medium, and often gives much internal relief. Any sudden impress of heat tends to close the surface vessels, much as the shock of cold would do, for the moment. Too warm a medium, beyond the excitement at first produced, rapidly induces exhaustion in young creatures. Older persons may be reminded that in consequence of the contraction of the surface-vessels by sudden chill, less heat is abstracted from the body by a plunge into ice-cold water than by a long stay in water not many degrees below the heat of the body. This applies to the bath in health; a good swimmer may indulge long in the summer bath, as exercise raises the body-heat; the morning "tub" should be a short process. A bath to lower fever should not be far below the degree of fever present.

Children sometimes suffer fatigue or chill from the way in which they are first dressed in the morning; they require a biscuit or some milk as soon as they get up, and before the ablutions begin; it is much better to give them a general wash in warmed water, in which they could stand while being sponged over with cool or tepid water, than to chill them when their powers of reaction are at their lowest. The soap used should not be irritating from excess of alkali, or from impure and imperfectly-combined ingredients. Babies most easily suffer from this, and also from want of care in the warmth of the water used, or from harsh rubbing; they also suffer many things both from the kind of dress and the fashion of dressing them; a broad band is so rolled on as to compress the abdomen, and comes up so high on the chest as to interfere both directly and indirectly with free breathing; then come complex, many-stringed instruments of torture, while thick folds of linen, flannel, or even macintosh curiously involve the legs; over all comes an inexplicable length of garment that is actually doubled on to the child, so as to ensure every form of over-heating, pressure, and encumberment. After a month of this process, aided by hoods, flannels, shawls, and wraps of all kinds, a strange variation is adopted; the under bands and folds are left, but a short outer garment is provided, with quaint holes cut in the stiffened edges, so as to make sure that it shall afford no protection to legs, arms, or neck, if it were, indeed, fashioned to cover or even to come at all close to them. To prevent the possibility of this, and thoroughly to expose the chest and arms a string or ribbon ties the edge of the degenerated or absorbed neck or shoulder-piece to what remains of a rudimentary or metamorphosed sleeve.

It is interesting to know that this picturesque fragment of some past phase of dress development can be preserved without the sacrifice of effective covering by inserting a close sleeve, or putting beneath the frills a little knitted jacket; or one of soft texture can be made to go moderately high on to the neck, with a seam over the shoulder, to let it lie flat to the upper part of the chest, and a sleeve cut with a good angle for the elbow and a very short inside seam; this bit of clothing, if of nice material and colour, has a pretty effect under the open-work embroidery, thus shown off to advantage without risking the exposure of half the child's body. Effective protection of the other half, which it is most important to keep warm, presents greater difficulties. Much irritation is produced by keeping damp clothes close to the skin, and more when caustic soda has been used in washing and is left from careless rinsing and drying. All impervious wraps are to be avoided; there must be frequent changes of linen. An infant's tender skin has to be kept dry; it is soothed and protected by the use of violet powder after being washed. The best toilet powders are, in some degree, antiseptic, and are constantly improving in this direction. French chalk, white fuller's earth, or Taylor's Cimolia already replace starch, and, instead of orris-root, eucalyptus oil, oleate of zinc or boracic acid might be, and are, used in nursery powder; some of the milder disinfecting powders may be sparingly brought into use.

Young children suffer much from the direct effect of a hot sun, or from hot weather and out-door exertion during the hotter parts of the day. Not only is sun-stroke, or the fever of insolation, a danger, but the enervation from heat renders children specially unable to resist many of the diseases of warm seasons, particularly diarrhœa. Besides care as to the time for, and duration of, exercise and exposure in hot seasons and climates, cooling the room by ventilation, perhaps with evaporation outside and ice within, should be attended to. The degree of warmth that enfeebles us is also that most favourable to many lower forms of life inimical to ours, and to many of the disintegrating changes on which they flourish; great care is therefore necessary in keeping rooms, inside and outside, clear of all refuse that might favour their development; also that no remains of food are left in dwelling-rooms, nor any article of diet kept there.

In warm weather various methods of artificial refrigeration will be required for the food kept in the house. A porous cover for some things, with means of evaporation, will answer, or ice can be used. It is not always easy nor convenient to keep the larder below 50°, yet there is risk in having any kind of food day by day in rooms at the temperature suitable for one's own health or comfort. There are other reasons to be given farther on for not allowing milk, bread and butter, biscuits, or fruit to be kept in the nursery, but here it is well to insist on one particular point—viz., that the temperature of a room for children to live in should be higher than that where food can be safely kept; and, conversely, that a room cool enough for a larder is not fit for a nursery.

Short contact with quite cold air or water is injurious to infants; prolonged exposure to the low temperature of a cold house or chamber still more so; most so when the air is not only cold, but damp. In houses otherwise healthy, the onset of acute disease in children, of inward congestions, glandular swelling, tubercle, dropsy, has started from the occurrence of unusually low temperature in their rooms, during convalescence, or exceptionally cold weather when the means of maintaining sufficient warmth have been neglected, or applied with difficulty.*

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* The germs of some diseases, as the *micrococcus* of pneumonia for one, are either always present in the body or readily developed from healthy protoplasm under the influence of chill or depression.

Children are also to be guarded against sudden changes of temperature. After some days in a well-warmed room the first promenade should be short. A child of four or five years old cannot bear a long walk in cold weather, but soon tires, and is then still more liable to suffer from cold. Out of doors, children passing from a sheltered to an exposed position, the turn of a street, the draught in a passage, may get a chill ; or, returning indoors hot and excited from running or play, the wraps being removed though the room to which they have returned is only half warmed, perhaps has become too far cooled from open windows or neglected fire, they catch cold more on coming indoors than on going out. An infant in arms is often chilled in this way ; closely muffled at starting out, carried near the nurse's body, under warm coverings, or shut in a carriage with closed windows, it is brought home, hot and perspiring, and laid down asleep (its load of clothes removed) on a cold cot in the chill quiet of the bedroom, while the other children prepare for dinner ; no wonder the youngest suffers first. Not only should the woollen clothes and coverings not be removed at once, but the chamber thermometer should be consulted. Prevention of illness is better than cure, and for both objects a thermometer in the children's room is indispensable. The delicate and expensive clinical thermometer, invaluable in marking the changes of disease, and useful in some of the variations in health when in skilled hands, is often misleading in the nursery ; there its only safe purpose, in the hands of the nurse, is to test the accuracy of the bath thermometer.

The best and most trustworthy means of being assured of the continuous well-being of infants and children is an accurate record of their weight. In infants weight alone may be depended upon ; for older children, growth as measured by height must also be noted. The two taken together, if increasing, afford evidence of progress, and, if interrupted, give timely warning of some impending difficulties. At first, gain in weight is much more marked than increase in length ; these increments seldom advance in close proportion to each other, though a certain relation between the two should always be preserved. An increase in weight often precedes further growth, and rapid growth is often interrupted while weight is being made up. Particular care both as to rest, occupation, and food is required when a growing child ceases to gain in weight.

The rate of growth for young children varies greatly at different periods of infancy, and follows laws of its own.

The proportion between the age, weight, and height of infants has a bearing on successful nursery management of much the same import as that observed all through the period of childhood. On comparing healthy, well-fed infants, with others on artificial food, very little difference in height is found at first, but instead of gaining four pounds of weight in three months, they gain less than three pounds, and advance by half a pound monthly, instead of by a pound or more. The rapid rate of increase in the earlier months of infancy, and the variations which are then observable, make a separate study of this period essential. A vigorous healthy child should double its birth-weight in the first four or five months, and treble it at a year old. This rate of growth is not uniform, nor does it proceed at any steadily-decreasing ratio, but is subject to the variations shown on the diagrams.

Fig. 407 is a diagram of the rate of increase for the first year, from "Our Homes" by permission :—

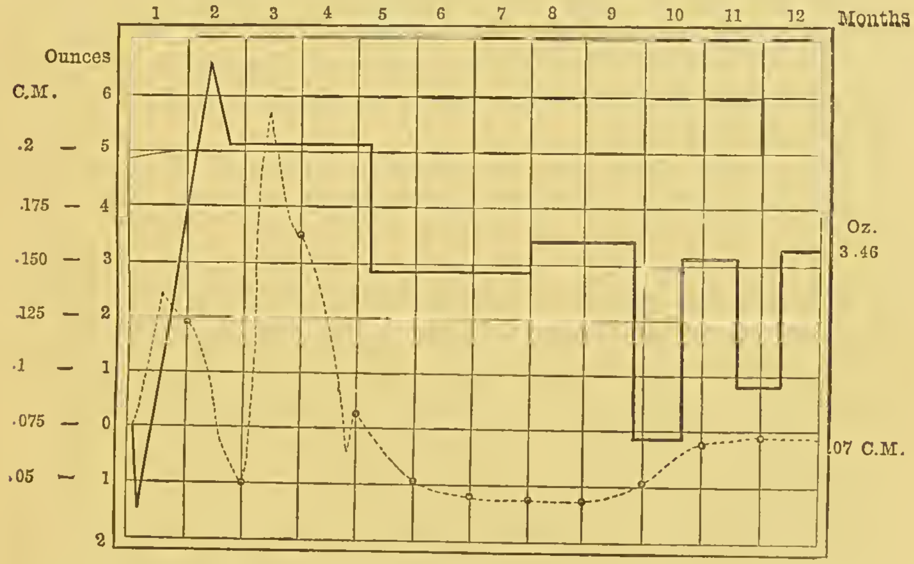


Fig. 407.—The black line shows the Average Weekly Rate of Increase in ounces, The dotted line gives the Average Daily Growth in centimetres, two fifths of an inch, from measurements by Dr. Haehner.

At first, under the new conditions of life, there is always a *loss* of weight, amounting on the second and third day to three or four ounces a day; so that a child three days old may weigh half a pound less than it did at birth. This is called the physiological loss, and is said to average six per cent. of the birth-weight. Nutritive matters, or the waste of past nutritive processes, stored up in the body of the child, are now utilised, and the way is cleared for new material to be readily assimilated. Very soon, after food is taken freely, the loss of weight ceases;

often a gain begins on the fourth day. The first loss in weight is mostly, or should be always, more than made up before the end of the first week. A progressive increase of weight now goes on at the rate of two or three ounces for the second week, at four and five ounces for the next two weeks, and at six ounces a week, or even an ounce a day, in part of the second month, when the increase is greatest. For the next two months a uniform gain, at the rate of five ounces a week, is maintained, while growth is more rapid than in the previous month. In the fifth, sixth, and seventh month, the rate of increase for weight falls to three ounces a week; growth also pauses a little, and both undergo some variation while dentition is proceeding. The natural period of most rapid growth comes to a pause about the fifth month in healthy children, when the teeth are forming, and a further demand on the nutritive supply is made. Care has to to be taken lest this pause be unduly prolonged, and a downward tendency advance to positive illness. We see also the first increase of weight checked as growth increases, so that some processes may be less active while a new direction is given to healthy development.

This holds good for all stages of growth, it is specially marked by a pause in the rapid growth of girls as periodic functions are established. In undue stress upon a child's mental powers nutritive energy is checked; a loss of weight should suggest timely relaxation of study before increase in height is interfered with; on the other hand rapid growth should be met with some leniency as to lessons, for attention is less sustained at such times, and work done then to be good in quality must be lessened in quantity. An example of the harm done by arrested growth is well seen in the transverse mark on the permanent teeth caused by severe illness, or a short convulsive attack, during the first dentition. The second teeth are then forming, and as they suffer permanently so must other structures essential to future vigour. It is possible that the fall in growth-rate from six to ten months, both in weight and height, seen in the diagram, would be less if dentition were aided by some fitter food supply. The formation of teeth is itself an evidence of healthy progress; any interruption of health delays their appearance. To persist in the use of diluted milk, highly charged with sugar, or thickened with the starch of corn-flour, instead of with whole meal or other more substantial food, until the teeth appear, is to become involved in a vicious circle from which the escape is slow, and not without risk. Good teeth are the sign of precedent health; not only do the first teeth decay early when health has been precarious in infancy, but in serious constitutional disease, the second set of teeth will be injured, and the six-year-old molars imperfect. In estimating healthy development at the end of childhood, the change of teeth, and the appearance of the bicuspids and large molars, at twelve years old, is as much part of healthy growth as the increase in weight and height then observable.

The diagram of these changes will serve to fix attention on normal progress of infantile growth, and as a reference-table by which any slight departure from health in the earlier months may be at once recognised, and so lead to the detection, perhaps to the removal, of its cause before any serious interference with sound development has occurred.

Much of the comfort and happiness of all concerned depends upon the uninterrupted well-being and steady nutrition of infants in the earlier months. Regular and systematic weighing, as the only trustworthy criterion of healthy infantile progress, has of late years been widely adopted in the public institutions of France and Germany. We are indebted to Anna Angell, of the New York Infant Asylum, for many hundred careful observations, week after week, for a year. The results agree very closely with those obtained by other observers; they are approximately given in the following diagram, Fig. 408. *(From "Our Homes.")*

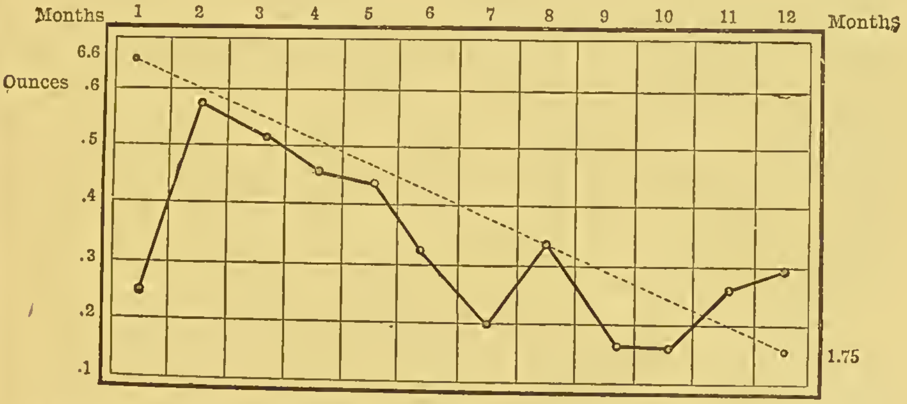


Fig. 408.—Average Weekly Gain in Weight for each Month, drawn from observations by Dr. Anna Angell, of New York. The dotted line shows Bouchut's estimate of the Progressive Decline in Rate of Growth.

By these Figures the rapid rate of growth after the first week is seen at a glance. The critical time for making sure that the infant is obtaining the proper supply of food, and is thriving on it, is in the first six weeks, and there is no means of doing this so reliable as weighing. In this way the check to nutrition is often discovered before any of the painful, and often unmanageable, symptoms of athrepsia are declared. There are some conditions unfavourable to the health of infants not discoverable by weighing, but this means would serve to point out the most frequent of them in time to avert their worst consequences.

For infants under three years of age, weight is the best criterion of progress; for children of three years old and upwards, height and weight must always be taken together; in order to judge of healthy growth it may be sufficient to do this three or four times a year.

Growth is very irregular in children and young people generally; perhaps two inches may be gained in two months, and for the next ten months not another inch, even up to the ages of ten or twelve years. This increase is most noticed in the spring and early summer with us; but it is not restricted to this part of the year as seems to be the case in more northern latitudes. While growth is most rapid, fatigue is readily induced; during the pause weight is gained, and work or training can go on again.

In the first two years after birth a child should gain twenty pounds in weight and ten inches in height. The chief increase in growth and weight is in the first year, thirteen or fourteen pounds of the gain in weight being in the first year, and seven or eight pounds in the second. The third year also is one of active growth, the first dentition is completed, and the child often gains four inches in height with four or five pounds in weight. From four to ten years of age a more uniform increase proceeds at the rate of about four pounds a year in weight and two or three inches in height; after ten years the rate of increase in weight for the next five years is doubled. Unsuitable food, defective teeth, bad hygiene, and the various infantile ailments at any time check nutrition, so that the weight of sixty-five pounds and the height of fifty-four inches, or four feet six inches, is not always attained before twelve years of age.

With big children the rate of increase is rather greater than in the small and weakly. A rather higher average is found for boys than girls; the boys may have at birth an excess of ten ounces in weight and half an inch in length, but this is of very little importance, as individuals of either sex may commence life at a weight of nearly two pounds, more or less, than the average. Setting aside the extremes, and taking children who are within a pound weight either way of the ordinary size at birth, there is less difference than might be expected in the rate of growth after the first year. This is also true for the difference in sex, and exactly corresponding weight and measure for both sexes at each age up to ten or twelve years occur; at this time girls grow as fast as boys or faster, and often increase as much in weight, but growth ceases sooner with them.

TABLE OF CHILDREN'S HEIGHTS AND WEIGHTS.

(*For both sexes: add to height half an inch for shoes, and to weight* 5, 7, *or* 10 *lbs., according to age, for clothes.*)

Age.	Average Height.	Average Weight.	Range more and less.	
			in inches.	in lbs.
At birth.	19 inches	7 lbs.	3	+5 − 2
1 year.	28 ,,	21 ,,	4	4 − 3
2 ,,	32 ,,	28 ,,	4	3
3 ,,	35 ,,	31 ,,	4	3
4 ,,	38 ,,	35 ,,	4	5
5 ,,	41 ,,	40 ,,	4½	5 − 3
6 ,,	43 ,,	44 ,,	5	6
7 ,,	45 ,,	48 ,,	4½	8
8 ,,	47 ,,	52 ,,	4	10
9 ,,	49 ,,	56 ,,	4	10
10 ,,	51 ,,	60 ,,	4	10
11 ,,	54 ,,	67 ,,	5	12
12 ,,	56 ,,	72 ,,	6	14
13 ,,	58 ,,	80 ,,	7	19+
14 ,,	60 ,,	90 ,,	8	20+
15 ,,	62 ,,	100 ,,	8	25+

The above are the limits found to be consistent with health in children. Divergences due to illness or markedly abnormal in either direction, have not been taken into account. The birth of a child weighing twenty pounds is recorded in the *Lancet*, Vol. II., 1886. A Gargantua at a year old, of three feet in length and five stones, or seventy pounds weight, who gained two stones in the next half year, is reported from Canada. Exceptional growth more often occurs from the age of twelve onwards; but neither Brobdignadians, nor Lilliputians, however healthy, are included in the above averages.

The range in both directions is given from cases under my own observation; the results have been compared with Tables in Charles Robert's "Manual of Anthropometry." Weight should vary with height, thus lads who are only fifty-four inches high at fifteen and sixteen weigh seventy pounds, the same as boys who are that height at twelve years; yet rapid growth has to be allowed for on the one side and mature age on the other. A youth five feet four inches at thirteen weighed over one hundred pounds, but others the same height at seventeen and nineteen years of age were from five to ten pounds heavier; an addition of this amount has to be made in estimating the right ratio of weight to height in adults.

The circumference of the chest, and the degree of expansion at different ages is noteworthy. The average chest measurements of 3,362 children from eight to ten years of age was from 22½ to 23 inches after breathing out, and 24 to 25 inches after drawing a full breath; of 3,478 children, eleven and twelve years of age, the average was, chest empty, 24 and 24½ inches; chest full, 26 and 26½ inches. Rather more boys than girls were measured, they were factory hands; the boys had a somewhat freer chest expansion. My own measurements give 27 and 30 inches for girls twelve years of age.

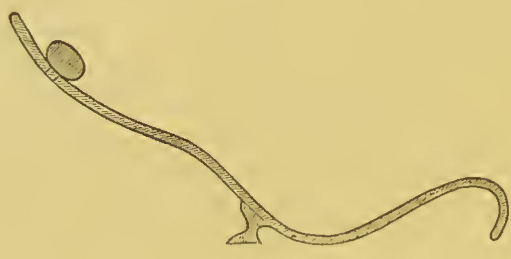
Of the changes produced by illness in children, two or three instances may be given. First, a boy ten years old, after scarlet fever had lost four pounds in weight; this he regained in one month after convalescence, and added another five pounds in the next three months. Second, a weakly boy, eight years old, height forty-six inches, weight forty-two pounds, had gained no weight and but one inch in height during six months' care in London; he then goes into the country for three months—August, September, and October—gains eight pounds and grows another inch; at nine years old he gets to the proportions of fifty pounds and fifty inches, the average height but not the average weight, until, after another year of care, he became strong and well. Another boy of this age, the same weight but an inch shorter, made no advance, and then, with slight febrile action, began to lose flesh, till his weight in pounds became less than his height in inches; he did not recover. It may be noted in the table that till the sixth year the height in inches exceeds the weight in pounds, and that, from eight to twelve years, the height in feet and the weight in stones nearly correspond; as growth advances a still further increase of weight over height should occur. A child in the fourth year should be three feet high, and weigh more than two stones; in the sixth year, three and a half feet high, and weigh three stones; in the ninth year, four feet high and four stones in weight. At adolescence, one stone should be gained for every two or three inches of height; eight stones for five feet four inches; ten stones for five feet eight; eleven stones for five feet eleven inches; and twelve stones for six feet of height is good weight.

The increase of short-sightedness with the increase of education, is an evil so important to guard against and prevent, that some of the rules to this end will be explained. Young children must have a good light while they are busy; they should not be long engaged with small objects very near the eyes, close attention to threading beads, or toys held to the mouth for blowing through, may lead to weak or short sight, or to squinting. A stooping position and too prolonged attention conspire, with other causes, as a child's instruction advances, to produce that widely spread but avoidable evil of civilized life, short sight. Books for the young should have large type and not be used in a dim or a hot glaring light. Insufficient or ill-arranged light obliges us to lessen the distance between the eye and the book; this is done in twilight, and must occur if the desk and seats are not rightly proportioned. Children are sometimes seated on insufficiently raised seats and so have their faces too near the table. Ten inches should be the least distance between the eye and the book, and copy-books should not be placed straight upon the desk, but so that the lines slope upwards to the right; a straight down-stroke can then be made without bringing the left eye too near the paper, or giving a twist to the head and body. For writing, the paper should be raised by an angle of 20°; for reading, the book is better raised to 40°; the two eyes can thus be moved along the lines without fatiguing the muscles or compressing the eye; then the book must not be too far on the table, or the child will have to sit on the edge of the seat and lean forward and press against the chest, or use the arms in support. The seats must have backs, not too high, and not standing backwards; the back ought to be straight, with a firm bar of wood about three inches broad to come across the loins close above the hips. The seat should be broad enough to take the whole length of the thigh, and a foot-board should be so fixed as to let the foot rest naturally on it. The edge of the desk must be perpendicularly above that of the seat, and just high enough to allow the elbow to rest on it, without displacing the shoulders. For school work the back of the seats should consist only of the support before mentioned; for boys it should be one inch lower than the edge of the table, and for girls one inch higher than the table. The keyboard of a piano is 2ft. 3in. high; for children, a high chair, with low back and movable foot-rest, should take the place of the music-stool. Too long a time at once is often directed to lessons; the length of application or attention has to be varied with the age of the child.

Not only short sight, but various spinal deformities, result from inattention to the above directions. The reciprocal influence of seats and lighting is well insisted on by Mr. Liebreich; he says, "A back-rest is necessary to avoid short-sightedness, and good light is necessary to avoid curvature of the spine. For preservation of sight, as well as of a normal figure, the possibility of remaining in a normal posture during school time, and especially when writing, is an absolute necessity."

Growing girls require a complete and easy rest for the body during some part of the day. In Mr. Liebreich's lectures on

" School Life and its Influence on Sight and Figure," a model of a good chair for this purpose is given. The essential part of this is the firm upper surface bent to follow the curves of the spine, and so give complete support and rest to the back. By prolonging the lower end a little downwards, and adding a projecting foot to the lowest part of the back, the framework is done away with, and the bent board will stand firmly anywhere, and form a very convenient reclining-board. Messrs. Callaghan, New Bond Street, are the agents for this simple structure.



Such boards are very useful, for a rest of ten minutes, in relieving the fatigue of the upright position, or in the intervals of lessons when active play is not to be had. By means of easy rest and varied exercise, rather than by the rigid back-board and wooden foot-frame of a past age, we may hope to avoid the tendency to spinal curvature and short-sightedness so frequently met with.

A careful hygiene should guard the early training of childhood from every hindrance to full development, and from all interference with growth, activity and health.

Children are sometimes seated on insufficiently raised seats, and so have their faces too near the table. The ordinary tables both for meals and for books or pictures should be somewhat less in height than the average dining-table. The tables for meals or lessons should not be more than 2ft. 3in. high ; a foot-ledge can be fixed across one end of the nursery table for the younger children ; a cross-bar joining the table-legs at a lower level may be used by others. Dining tables are nearly 2ft. 6in. high. Some dining-chairs are 1ft. 6in., not high enough for young people under twelve years of age ; a cane-seated frame with raised backpiece, can be added to the chairs, and a footstool or hassock placed for the feet. Besides the high chair for infants, with its lower part convertible into a table on occasion, several low chairs, and a low stand or table big enough to set out an ark or a toy farmyard, should be provided. The top of this, fifteen inches from the floor, can be raised or extended by a movable board kept for the purpose. The little chairs should be eight inches high, with seats nine or ten inches square; others measuring twelve or fourteen inches in each direction are useful for children of all ages. The infant's chair for sitting at table is usually twenty-four inches high at the seat, with a foot-rest five inches below that. Another is made twenty-two inches high, with a foot-rest at six inches; the seat can be raised by a cushion. A child seven or eight years old requires a chair twenty inches high, with a midway foot-rest.

All rooms, whatever their purpose, should be well lighted, so that everything in them can be distinctly seen, and no part left in obscurity, nor in danger of neglect; the door should not be directly opposite the fire-place in day-rooms, without a special contrivance for ventilation, to be described farther on, as the draught is mostly from under the door to the fireplace, and so along the floor; this can do no harm in the bed-room, but is bad in a sitting room, and specially bad for children, who do, or should, spend much of their daytime in creeping or playing on the carpet.

The windows are a great means of ventilation as well as of lighting, and can be used either as outlets or inlets of air; they should not be near either the door or the fireplace, for in ventilation the outlets and inlets should not be near together; the door is always an inlet, and the fireplace should always be an outlet.

The importance of careful and efficient ventilation of the rooms occupied by children can hardly be over-estimated. The air of a closed room soon loses its freshness even when unoccupied. Chemically the proportion of oxygen may not be appreciably altered, but the more active, or ozonised, part of it is changed; innumerable particles are brought into contact with it which, if not "stealing and giving odours," may add what is imperceptibly injurious, and will certainly take away from it the quality of freshness. Movement of air through a room is a first essential of ventilation; then the quantity and rate of movement has to be considered, taking care that the temperature, and other qualities, are so preserved as to be both pleasant and wholesome.

Exact comparisons are wanting as to the relative amount of respiratory products between children and adults; children, though with smaller organs, have more activity of function, a quicker rate of breathing, and tissue-change is rapid. Instead of considering two children as one adult in the cubic space allotted and the amount of air per hour required, "the safest course is," Dr. Parkes observes, "to have the same rule of whatever age, excepting the very youngest and oldest, who require special conditions of warming." He also adds, "If any difference is made, children ought to be considered as evolving not less than 0.45 of a cubic foot of CO_2 per hour: the amount 0.6 ought to be retained for women, and 0.7 ought to be allowed for men. In this way the minimum hourly supply in health in repose ought to be for children 2,250; for women 3,000; in ordinary sickness 3,400 and 4,000 cubic feet respectively." A larger initial cubic space is required for a room that has to be continuously occupied for some days and nights, than for one occupied only at night; again, the space required in an ordinary bed-room for each person is greater than is always necessary in a room only used for a limited time, as for meals; in these rooms a greater amount of air can be admitted at one time, and they can be swept through with fresh air at more frequent periods.

The efficient ventilation of a child's first nursery, under the special conditions of warmth required, demands a full allowance of cubic space to begin with. In calculating the necessary space for bed-rooms, where equable warmth is required, any height exceeding ten feet is disadvantageous and to be left out of account. A good double-bedded room should be twenty-five feet square, giving a clear 2,000 feet for each occupant after deducting the space taken up by furniture. No bed-room should be without a fireplace.

The nurse's room should be not less than 15 feet square, if the child has to sleep there; no food is to be kept or prepared in the room and no clothes dried or aired there; moreover, a convenient lobby must provide for the immediate reception of all that has to be removed; soiled clothes should be taken out at once, and covered with a weak deodorising solution.

If any accident or illness befall a child, not only separate care but an increased air-space is at once needed. It has been calculated that a single drop of decomposing matter from a burn or abrasion of the skin would supply one hundred million* diffusable particles, or "germs," to the air; or from five to ten times the number likely to be found in the atmosphere of a good-sized room. With the most scrupulous attention to every detail of cleanliness, to keep the air pure, it is still necessary that invalids should be changed from one room to another during illness, and afterwards removed for a change of air altogether. What has been called the two-room treatment of disease should always be adopted; for infectious diseases these rooms should be in the upper part of the house, or on a level above the nursery floor.

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* It is said (Graham Lectures, 1887, T. E. Thorpe) that the smallest organic particle visible by the microscope contains near a million organic molecules, and that a molecule of organic matter has some 50 elementary atoms. The smallest microscopic cube as yet measured has been calculated to hold two million organic particles, equal to 60 million molecules of oxygen.

Ventilation of the spaces under the floors of houses is very necessary; gratings in the opposite walls should admit air-currents between the floors and ceilings; any evils from chilling the floors are less and more easily obviated than those arising from the heated and stagnant air of the spaces beneath. Organic particles from the room penetrate and settle in the joints of the boarding, or are scoured into them with moisture enough to make them dangerous. The temperature of these spaces beneath the boards often becomes higher than that of the room—much higher near any stove or fireplace, and remains long at the point most favourable for the development and activity of infectious particles.

A room fifteen feet square and nine feet high may afford sufficient cubic space for a nurse and two children; with good and careful management, a nurse, infant, and two other young children, have occupied a bed-room of this size without detriment to health; no useless articles of furniture or of drapery were allowed entrance; both a dressing-room and a bath-room were close at hand, care was taken to keep the air of the room pure, no open vessels were allowed to remain, the door, never quite closed, admitted light and air from the passage, the two windows were partly open on the summer nights, and the fire always lighted before bedtime in the winter. Children from seven to nine or ten years of age may have separate bed-rooms, and after that age a separate dormitory for each is requisite. A space of fourteen or fifteen feet by eight or nine feet wide permits of a bed four feet wide to be placed between the door and the wall, and a fireplace in the opposite wall to be beyond the foot of the bed.

A child until two years old must sleep with the nurse, and requires the same allowance of cubic space. From two to five or seven years of age two children may be estimated as one adult in calculating the amount of initial air-space wanted in the bed-rooms, and this only in rooms of the best construction and management; each candle is to be counted as a child, and every gas-burner as a grown-up person. In well-arranged houses a good supply of pure warmed air will enter the bed-rooms from the staircase and corridors by spaces purposely left near the floor or under the door; half an inch left under each door, or three-quarters of an inch at the top obtained by bevelling the upper edge of the door, would provide such spaces, which should together be equal to twenty-four square inches for each person;

theoretically, the inlets and outlets should be equal; practically, they equalise themselves whatever we do, and one or two grated openings may be placed in the angle of the walls and ceiling. A fire will draw to itself a supply of air, and so ensure ventilation, and perhaps a draught; an open fireplace with no fire in the winter will let in cold air, unless some means of prevention are used. A Galton's stove is so constructed as to warm the air before it is admitted to the room.

The windows should be provided with shutters, both to keep off draught and to shut out some of the light when this may be necessary; they aid materially in lessening the chill that in cold weather always strikes in from the windows, and then require the aid of curtains for further preservation of warmth. A stout linen or jute fabric makes a good protective window-curtain for the winter. All woollen hangings are objectionable in a bed room, as they readily absorb moisture and all organic particles suspended in it or floating in the air; the bed-curtains should be confined to the upper end of the bed, and be of dimity or some thin linen material. The ceiling of the room should be such as to bear rubbing over; it is better of a grey or cream colour than white, so as not to reflect too much light on the upward gaze of children. The walls of the bed-room are best distempered, or painted in some even tone of quiet colour; if the wall is papered it should be varnished over, and the paper must have no bright-coloured, intricate pattern spots, and no vivid greens likely to contain arsenic. The floor must not be carpeted all over, certainly not under the bed, and it is better to have the boards stained and left bare round the sides of the room; the top edge of the skirting-board should be rounded off in all rooms for children. Iron bed-frames should have round edges. Slips of soft carpet by the sides of the bed, and from the door to the fireplace, if not all over the centre of the room, are sufficient.

The materials in general use for bedding are such as comply fairly with the qualities that are required in them and the purposes to be served. Wool, though the best material for preserving the warmth of the body, absorbs moisture very rapidly; but the moisture from the breath and skin contains much that is better not absorbed, consequently, the woollen blankets are properly covered with linen or cotton sheets. Cotton is best for the night covering, as it is very non-absorbent of water, and conducts heat rather less rapidly than linen. Linen makes a very good covering for the mattress; this should be stuffed with horsehair, and the under palliasse with straw; these are the two materials least absorbent of water and permeable organic matter. Wool and feathers are most absorbent, hence the stout tick and white linen cover requisite for a pillow-case. All hydroscopic substances absorb animal effluvia most freely, and more so if of a dark colour.

The sleeping-rooms for children should never be at the top of the house, or there will be tiresome stair-climbing; the day-room should never be in the basement, as arranged for in some otherwise good suburban houses, for the air of a room below the ground-level can never be dry and pure. No sink or cistern is to be placed on the same floor as the nurseries. The position of the closet has received full notice elsewhere. Any water-closet, of course, will project beyond the walls of the rooms so as to allow of cross ventilation and preclude all air entering from it to the house. The cistern for the supply of this closet will be out of doors, covered, and sheltered from the sun. Warmth fills any space above the water with vapour that readily entangles organic particles and favours their increase. An indoor cistern is likely to give off malarial moisture as well as itself to receive taint.

Drinking water should be brought up fresh, filtered, and kept cool. Children require a large supply; this may be supplemented by some drinks, as lemon, or toast-water, made with boiling water, which has been thus further purified; it will remain fit to drink for a day or night, if covered, in a cool place, and not kept too long. Any tap for drinking-water is never prudent; nor should there be a tap for any domestic supply of water near the nursery. A tap implies a something to catch drops from it, and so either a damp surface is maintained, or there must be a pipe to carry off the overflow, which, if it conducts nothing bad into the house from a distance, becomes the source of multitudinous particles that will ferment everywhere. So with a sink, however ingenious the trapping, foul air returns by the waste-pipe. This must be as short as possible, just so as merely to pierce the wall, and open with a free end over a catch-basin; the pipe will be foul even if only clean water pass through it, and it is difficult to prevent it becoming part of the ventilation of the house, mostly as an inlet. The manifest convenience of having a sink near to rid the nursery department of soiled water has to be weighed against the tendency of all servants to misuse such convenience, and it is best to decide against such sources of mischief, and to make the best of a well-placed lobby or closet for the temporary reception of waste. All slops must be carried down to some place in the basement; washing up is best done below stairs in some outhouse or scullery. The waste-pipe of the bath is a difficulty; it must be short, and end directly in the open air without any close connection with other pipes or drains; the bath opening of it should be kept closed when the bath is empty. The bath-room is often a vestibule to the closet, or an offshoot of the dressing-room; where a lavatory may be convenient, the washing-basin should open into a removable slop-jar beneath; and, if this is in a lobby to the closet, besides a small hand vessel there, a wooden frame ten inches square, with a moveable round lid, should cover an ordinary chamber vessel, a little raised, and so placed as to be ready of access for children.

The day and night nurseries are better situated on separate floors, or at some distance apart; where this cannot be done, they should be arranged not to communicate directly with each other, so that one set of rooms may have the windows left open to the air for a good blow through, without fear at the same time of the other room being chilled.

In the bed-room less light is needed, more care is required as to draught, nor do children want to be constantly looking out of window. Moreover, a large window is the great cooling surface in a room, one which cannot be banked up and shut off by thick heavy curtains, as in the sitting-room, nor can its cooling effect be counteracted by a jolly fire; that would be disturbing and out of place in the children's sleeping-room. Neither thick bright carpets on the floor, nor pretty patterns on the wall, nor shelves, nor books, nor pictures, nor the endless little ornaments and toys of the sitting-room and play-room, would be in place in the bed-room.

There should be a dressing-room in close proximity to the bed-room, where the children's clothes can be left in readiness for the morning. A fire can be lighted here on cold nights and mornings, or hot water brought; a fan-light over the door of this room would convey light enough to the nursery for the night. The nurse's room must communicate directly with the children's bed-room, and so give them sufficient light. The nurse must have means of illumination at command; a candle, with a glass shade ready, can be lighted at the night-light. A covered vessel over an ordinary Child's or Price's night-light will serve to keep food warm for an infant. A gas-light in a lobby, with glass over the doors leading into both rooms, is easily turned higher when wanted, either for better light, or for warming food with a proper arrangement.

There is always risk in using spirit lamps in the nursery; the open flame is most dangerous, and the safest lamp may be upset. A solid-flame spirit-lamp, with stand, kettle, and other additions, affords a convenient method for warming food, or even for boiling water in the night. This is better done out of the bed-room, not only to avoid a chance of accident and the disturbances of noise and glare, but to prevent the possibility of food being brought into the room before it is wanted. Milk is specially prone to absorb into itself any volatile or organic emanations floating in the air; and the very qualities that adapt it, in a way that no other food is adapted, to be the most suitable nourishment of a child, render it more liable to convey injurious particles to the child's actively-absorbent surfaces. Any article of food brought upstairs for the night should be carefully covered, wherever it is placed. Milk requires more care than any other, both as to position and temperature; the nurse should have it brought up fresh at the time it is wanted for use, and see where it is kept: if not left in a sealed can, at least it should be covered, and not put near cheese, game, or remnants of food. For night use, slightly heating it and adding a little salt helps to preserve it from change. The feeding-bottle should be "scalded" after use, and the tube immersed in cold water until it is wanted again. Microscopic germs, and even masses of fungoid vegetation, were found in twenty-eight out of thirty of the caoutchouc tubes and nipples in use at a *crèche* in Paris; in some of those said to be clean some acid milk remained containing *bacteria*, these would soon set up offensive changes in any new milk added, and are themselves known as "germs of disease."

Just as no article of food and no part of the service for meals is to be kept in the day-room, so neither are they, or any clothes or linen not in use or on the beds, to be kept in the bed-room. All cupboards, closets, and wardrobes diminish by their size so much of the cubic space calculated for fresh air, and most contain things that tend to spoil its freshness. A closet built up to the ceiling in the recess by the side of the fireplace is better than a wardrobe; no dust can settle upon it, and it can be more easily cleaned and rubbed inside. The store-room will be in another part of the house, and all airing and drying of clothes should be done away from the nursery.

The robust aspect of healthy children is good evidence of the thorough hygienic state of the dwelling-house, and of the excellence of its domestic management. A ruddy glow in the face of a child tells at once of sufficient outdoor exercise and indoor ventilation. Without a full amount of fresh and pure air the cheek loses its colour and the flesh its firmness; the blood is impoverished, its circulation languid, and nutrition is interrupted. The effect of what is called "change of air" in stimulating these processes is well-known, and particularly obvious in children. Very often the good that would be done in this way is put in jeopardy by too much attention being directed to the particular place where this change is to be obtained, and too little to the sanitary state of the house and the size of the rooms to be occupied. Perhaps the smaller bed-rooms are allotted to the children, unmindful of the fact that they spend nearly half of the twenty-four hours continuously in the bed-room; or they have but one room for meals and for play, so that if kept indoors by a wet day they have to pass many hours together in one room. It may be that neglect of some of these particulars at home has occasioned the necessity for the change; if they always received the attention deserved, both at home and abroad, periodic visits to so-called "health resorts" would be required less frequently; and we might find a more uniformly healthy appearance among the children of the residents at these places were the above rules generally observed.

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CHILDREN'S TEMPERATURES
IN
HEALTH AND DISEASE.

THE endeavour to give to the study of infantile disorders a certainty approximating to that which we bring to the investigation of the diseases of adults needed exact observations, both in the temperature changes of the earliest period of infancy, and in the ordinary variations of the pulse and respiration. To supply this want, more felt when the patients cannot give an account of their ailments, is attempted in the first part of the present paper.

The fœtus *in utero* is said to have a temperature higher than that of its medium by nearly one degree Fahrenheit. This difference is not observed at birth, for the temperature of the mother is then somewhat disturbed. How far the unborn child's temperature may be raised by fever in the mother is uncertain. During the ingress of small-pox near the end of pregnancy, the mother's temperature at 104°, a healthy child (Case 14, see p. 66) is born with very little rise of temperature. Once when a sudden rise of temperature to 102° occurred near the end of labour, a temperature not exceeding 100° had been communicated to the child. A subnormal temperature has been found in children born prematurely and also in those who have exceeded the ordinary term.

Usually the temperature of the infant at birth corresponds closely to that of the mother, so that generally it will be about 99°. Taking the two extremes of normal temperature at birth, where the mother's temperature has exceeded 100° the child's has also; and once, when the temperature of the mother was as low as 98°, so was that of the child.

In these cases, as in several of the more ordinary instances, special means were taken to ascertain this correspondence by inserting a thermometer of small bulb and long index within the spincter ani of the child immediately after birth. The same instrument was made use of in most of these observations; this was before the self-registering index had been adapted to clinical thermometers.

In young children during health the thermometer rarely exceeds 98°.6 in the mouth; this is a reason for placing the normal line at this point on the small sublingual thermometer, while this mark may remain at 98°.4 on the one for axillary use; another good reason for fixing the normal at 98°.6 is that it corresponds exactly with 37° Centigrade, and is probably nearer the true average body heat.

The point of interest next to be noticed is the uniformity with which the infant acquires that particular degree of temperature (98½°) which is to become the index of the health of the individual from infancy to extreme age under the most opposite conditions of heat and cold, literally, from the cradle to the grave.

Warmth, a product of every living body, is only favoured and preserved by the state of the surrounding medium, not produced by it; food must supply the material for nutritive changes within the body that produce heat, while growth and development in special structure and function proceed. In the higher forms of life, where conscious energy is evolved, the alternation of sleep becomes a necessity; simple forms in the lower stages of existence may slowly vegetate or grow with no other changes of activity than such as come with the varying degrees of heat and light or the conditions of the medium in which they live. Our more complex bodies, endowed with warm blood and organised for this vital current moving into direct and constantly renewed contact with the air, start at the instant of birth into such activity of function, such conscious sense of change, that, but for the repose sleep brings to the store-centres of energy, exhaustion following effort would weaken the delicate structure on which all vital actions depend, and impair, instead of aiding, growth and strength.

Many causes may more readily depress our body-heat at the extremes of life, and the young require to be carefully guarded from much variation of external temperature in either direction. It is obvious that in relation to surrounding cold, the smaller the warm body the sooner must its heat be abstracted; it is found that exposure to extremes of heat sooner overpowers the heat-regulating processes in the young, but it remains a wonder how all human beings, in any climate, at every period of life, preserve one even body-temperature. We know that the warmth of some animals at certain periods, as during hybernation, and under some conditions, varies somewhat; it is maintained above that of the medium around in all. One condition of healthy action of our bodies is that the temperature should be nearly uniform, always near 98°.5 or 98°6. Fahr., just 37° Cent.; it may be one degree lower during sleep, or half a degree higher during great activity of function. This heat is kept up by the molecular change in the tissue accompanying nutrition, secretion, and waste effected by the oxygen carried in the blood, together with nutrient material, in every part under the influence and even control of its innervation. Heat is lost by direct cooling of the blood as it circulates in the vessels of the skin and of the lungs; some is carried away in excretions; much is set free by the moisture given off both by the cutaneous and pulmonary surfaces; evaporation always cools.

An example of the complex and delicate reaction of the whole heat-regulating machinery of our bodies is seen in the sensitiveness of the skin to cold. Under this stimulus the cutaneous vessels contract, allowing less blood to enter, so that the loss of heat by the surface is checked; at the same time more blood is sent to the interior of the body with conservation of heat. Not only cold from without, but irritation from within (often such as interferes with heat-production), also sets in action the same heat-regulating mechanism; a reflex influence on the vaso-motor nerves of the skin causes pallor, or coolness of surface, or in a further degree makes what is called goose-skin.

Under a different stimulus the cutaneous vessels relax, perspiration pours forth, and the interior of the body loses heat. To man as a denizen of sub-tropical climates a warmth of 98° seems natural; amidst perfectly congenial surroundings the primary sensation would not strongly urge his intelligence to expedients useful against heat, rain, wind and cold. No place can be always free from those changes, and a wider experience would soon enforce the necessity of some provision against them. Shelter, fire, and clothing are the earliest conquests of humanity, the object being warmth; to keep oneself warm is cited as a proof of innate or mother wit in its rudimenmentary form. To long and constant success in this effort the equable body-heat of our race may be due, and this capacity for keeping up an even temperature is not unconnected with the progress of communities, the growth of social manners, and the capability of sustained powers of will and thought.

An infant no sooner breathes than the heat of the body attains the normal ; the first differences of warm or cold felt by the skin, the first sense of touch, excite the requisite movements to bring air into contact with the newly-diverted blood current, and life goes on at full rate. Respiration is aided by a child's first exertion in crying; washing and rubbing also affords an exercise beyond the muscular kicks and struggles excited; all these quicken change and tend to develop heat. Let suitable covering retain this warmth at the surface, sleep will then be quiet and prolonged. A healthy child born at term has a reserve supply of material to keep up the body-heat, so that a little liquid only at long intervals is all the food required for the first day or two, and that little can mostly be supplied by the mother.

To take an ordinary instance: (Case 1) a boy born quite at the full period without undue difficulty at 1.30 p.m., the temperature taken in the rectum at 2 o'clock, was 98°.4, the child having been but slightly covered in a not very warm room ; the surface generally was colder, but at 3 o'clock, after the child had been washed and dressed, 98°.4 was easily obtainable in the folds of integument at the neck. At 8 p.m. the temperature taken at the neck was still 98°.4, and next morning the same, though the night had been passed sleeping in a bassinet; little or no food had been taken, as the child seemed too well nourished to have much disposition to suck. At 11 a.m., after washing and dressing, the surface temperature in the neck was 98°.8 with a slight loss of body-weight.* During the month, with increasing gain of weight, the supply of breast milk had to be supplemented by the bottle, but the temperature was always found close upon 98°.4. The child was weaned in the second month, and after some variations the temperatures taken during a week were all nearly the same.

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* The loss of weight marked in the first few days is constant ; it is not owing to the want of nutriment or to the kind of supply given. The most appropriate ingesta are those which aid the clearance of waste material from the bowels and kidneys. If the infant wets the napkins freely it is receiving all it needs in the way of fluids, and at this time much is needed, for the proportion of solid matter to be passed in the urine is increased tenfold. A week later, with six times as much urine voided, only half this active waste is evidenced.

Of two children born prematurely, both at the period of eight months, the one, a boy (Case 2), twelve hours after birth, had a temperature of 98°.7, very nearly what it was at birth; the next day the rectal temperature was 99°, though only a little water and sugar of milk had been given; a wet-nurse was then obtained, and after some irregularity at first, the temperature for several days continued between 98½° and 99°: the other, a girl (Case 3), having the extreme of high temperature at birth, was considerably below the average on the second and third days after; on the fifth and sixth days there was a temperature of 98°, though the advantage of suitable nourishment was wanting.

The extreme instance of low temperature at birth (Case 4) was a girl, supposed to be beyond the full period, and certainly of full size; the cord was in a tight knot, and some little time elapsed before respiration was perfectly established; six hours after birth the temperature *in recto* was still 98°, the surface had become warm and of good colour, nothing had been swallowed and no urine passed; next day there was a rise of half a degree; after that, the supply of breast-milk being very free, 99° was always obtainable, whether the child were close to the mother's side in a greater heat than seemed wholesome, or exposed in washing and dressing to a lower temperature, and for a much longer time than seemed prudent.

The diurnal variation of temperature, which becomes the rule of later life, is hardly to be observed in young infants; their sleep comes as readily in the day as in the night, and their food is often as easily within reach in the night as in the day. A somewhat higher temperature is found in the latter part of the day by the fourth or fifth month, but even then a great difference between the morning and evening temperature would indicate want of attention on the part of the nurse, or delicacy of constitution in the child, or both. Food is the source of heat, and the equality of temperature in early infancy is mainly dependent upon fitness of food and frequency of feeding. Two hours, or if the infant has been sleeping, three hours may be requisite for a full meal to influence the temperature of a healthy child : thus of three observations taken in the second month, in Case 1, two were taken within an hour of the mid-day meal, giving 98° and 98°.2 in the neck, 98°.6 in the rectum ; the third taken at 3 o'clock was 99°.1 in the neck, the child had been sleeping since its meal, which was a full one.

The right time for this supply of food is after sleep. Sleep is interrupted by a sense of want as well as by other discomforts ; these obviated, as by change of position or of articles of clothing, or by warmth, sleep returns. Sometimes a tight band or a scratch may disturb sleep, or there may be fulness from flatulence after food, or distension from over-feeding, or heat, or thirst ; so that if restless when food has recently been given, instead of offering more, search first for the possible cause of unrest ; lighter covering or a tea-spoonful of cold water may be all that is required. But if this sense of want underlies the discomfort, or has become an urgent element of it, no conciliation is possible without the supply of food.

During perfectly undisturbed slumber, while motion and sensation are at rest, secretion and nutrition are active, repair goes on, waste is less, and the temperature of the body is slightly lowered. This lowering is more marked in profound sleep, or if sleep be prolonged. Under the stimulus of food the child's temperature is at once restored; give only a small quantity of food, two or three ounces of liquid one degree above the child's body-heat, and the whole body will be raised half a degree in temperature, an increase twenty-fold that of the heat supplied. Milk and water, taken nearly cold or several degrees below the child's temperature, will determine a similar rise more slowly produced. A child at the breast seldom takes more than two ounces at a time. It is a common error in artificial feeding to mix too much at one time in the bottle. Children are soon induced to take too much, and the habit of sucking is unduly encouraged. No infant will take hot food ; a careless nurse may place in a bottle for a child liquid as hot as the tea she drinks, but, saved from scalding by the elastic tube with which most infants' bottles are provided, the child, however hungry, will not draw it up until the temperature has fallen to 110° Fahr., or what would be considered barely tepid, if not quite cold, by a tea-drinker.

The immediate effect of a meal, or of warm liquid merely, in raising the temperature of the body, is less noticeable in infancy, partly from the small quantity of the natural meal and partly from care not to give the artificial food too hot. In the case just given (Case 1) the infant, when three months old, was restless and in some pain; the diet being equal parts of milk and water, some curd passed undigested; the child had been recently crying much, the temperature was 98°.2 in the rectum, and until the descent of some fæcal matter was only 98°. Four ounces of thin, sweet liquid at a temperature of 101° was given in a tube bottle; the half of this was taken while the temperature was near 100°, and most of it while above 99°. In a quarter of an hour the rectum temperature reached 99°.4 during the passage of a considerable quantity of liquid fæces; in another quarter of an hour the temperature in the rectum was still 99°.

When the child has suffered weakness or want a direct increase in the bodily temperature follows the administration of food. Thus, in Case 2, before noon on the fourth day, the child neither having been washed that morning nor fed for some hours, the surface temperature was 97°, and that *in recto* only 97°.4; after suckling the temperature quickly rose to 98°; the next day it was 98°.4. Also, in Case 3, when the child, not being suckled for the first three weeks, had thrush and was in danger of death from inanition, the debility was too extreme when the child was put to the breast for an immediate effect to be produced by the new food; twice the temperature had been near 96°, once even down to 95°, and generally not much above 97°; during the first two days of breast-milk the temperature was only 97°, it became 98° both *in recto* and in the folds of the neck by the evening of the second day, when it was also as readily obtainable at the surface as the interior of the body; there were at the same time other signs of the return to health of the mucous membrane as well as the skin; on the third day the child was washed and dressed after three hours' sleep; at 10 a.m., without being nursed, the temperature was 97°.8 on the surface, and less than 98° in the rectum; a full meal was then given, which caused an increase of a whole degree of temperature; before noon, the child sleeping, 98°.8 was easily obtainable in the folds of skin at the neck.

A full meal of some of the more stimulating artificial infants' food, or even a full natural meal, will sometimes flush the head and face, and rouse the heat regulating reaction; the vessels of the skin fill, and free perspiration dissipates any excess of heat production; this is not the time for replacing the infant in a heated bed or cot, but rather for change of covering, or a complete undressing for sponging the whole surface of the body. Cold bathing has an effect in raising the temperature of a healthy child, and while no stimulant is so valuable as food, the influence of the bath in equalizing the temperature of the body ought not to be overlooked; the greatest effect in raising the temperature of the surface is produced by the combined effect of both. The regular morning bath is better given a little time after a slight meal than immediately after a full one. The water should only be tepid; after free ablution the use of water a little colder than the bath provokes a reaction that reddens the skin, and, instead of lowering the temperature of the body, tends to equalise it by exciting on the surface a degree of warmth already existing within.

Where the circulation is feeble, or there has been fatigue or a chill, warm liquid and external warmth combine best in this object. The effect of food and the bath was noticed in a child of four months (Case 5). On October 1st, at 10 a.m., the temperature in the axilla before breakfast and the bath was only 97°.8, while in the rectum it was 99°.6; a little later in the day the axillary temperature was 98°.7, that of the rectum 99°.1: the bowels were confined. So that here not only is the general temperature restored to the surface, but it is equalized, for while that taken in the axilla is raised by nearly a whole degree, that in the rectum is lowered by exactly half a degree. The next day, October 2nd, before washing and feeding, the axillary temperature was 97° only, the rectal 98°.6; the bowels had become relaxed. On October 3rd, at 10 a.m., after washing and feeding, 98°.2 was easily obtained in the axilla. On October 4th, the evening was chosen for the same inquiry; before having food and being undressed for the night, the temperature was only 96° in the neck, 97° in the axilla, and 99° in the rectum; later in the evening 98° was obtainable in the neck while the child was asleep. A similar observation was made upon a strong, thriving girl, three months old (Case 6), where the natural nourishment was supplemented by the bottle. At 5 p.m. the axillary temperature was 97°.4, the rectal 99°.1; some little gastric irritation had been set up by the use of farinaceous food. Another observation was made in this case some days after all farinaceous food had been discontinued, when 98° was obtained in the axilla and 98°.3 in the rectum, but this was earlier in the afternoon, not long after a meal, and just after a sleep.

Sleep aids powerfully in maintaining the equilibrium of temperature, its effect is obvious in the above instances: when deficient in the day the temperature keeps up, and though its loss at night has been found associated with a low temperature, yet sleep, if long continued and profound, indirectly tends to lower the heat of the body by its influence upon respiration: thus, Case 3, at two months old, while wakeful, with a pulse of 150 and respiration 50 in the minute at 4 p.m., had a normal surface temperature, and one of 99° *in recto;* a day or two after at noon, while in a deep sleep that had lasted two hours, the pulse was 120, the respiration 30 in the minute, and the temperature, below 98° in the neck, was only 98°.4 in the rectum.

Respiration has the closest and most important relation to the heat of the body, of which it is the efficient cause; on the establishment of this function an independent temperature is commenced, which it continues to maintain and regulate. There is always a certain ratio between the respiration and circulation: at birth the regularity of the fœtal pulse, yielding to the influence of new stimuli, at first becomes greatly accelerated; during sleep it is again down to 120, and may subside to below the fœtal rate during the first two days; the pulse at this time is often as low as 100, but as nourishment becomes more abundant it increases in frequency, and will then sometimes be found, consistently with health, to be 140 or 150, and the respirations 50 to 60 in the minute.

The respiration varies even more than the pulse; within the first week it has been counted at 80 during one minute and at 40 in the next; shallow breathing may have to be supplemented by yawning, or some imperious want in the economy indicated by crying, an act of great physiological utility. Ordinary quiet respiration in infants has a peculiar rhythm, consisting of a series of fifteen or twenty short pants, with pauses at every quarter or half second, calling to mind the rhythmical contractions of the young jelly fish when separated from the narrow pedicle which held it to the parent polype : there is the same regular action of the newly acquired power and the same short pauses, as if at first fatigue necessitated rest.

Notwithstanding the readiness with which the breathing and pulse vary in infancy under the slightest exciting causes, they maintain a relation to each other which is special to the early period of infancy, and differs from the ordinary ratio of childhood and adult age ; there is also either an innate or readily acquired habitual difference in the rate and ratio of these acts in different individuals. The class difference which demands attention is, first, that in early infancy the ratio of the pulse to the breathing is only *three to one*, it may be even less ; and next, when this is steadying down to the more mature ratio of *four to one*, any causes that quicken the rate also increase the ratio. The period to which these signs of infancy-proper may continue, varies ; the first, characteristic of the earlier months of infancy may alter at three or four months, or continue beyond the second year ; this persistency of the infantile condition is generally associated with debility, and may be traceable from this cause for a year or two longer ; the second, found in most of the diseases of childhood, characterises what is known as the period of dentition, but it has no special dependence upon the appearance of the teeth ; it is connected with rapid development, when change is active, the breathing is quickened that the temperature may be regulated.

The individual differences which in after life may become permanent are less confirmed in infancy if not altogether accidental; thus the infant (Case 5) with a pulse as low as 100 when three days old, had also at three weeks old a pulse of only 110 and a respiration of 30, yet at three months, the temperature being both times 99° interiorly, the pulse is 130 and the respiration 40, the difference being from some addition made to the food, which was not over abundant while the child was suckled exclusively ; the infant (Case 4) with a superabundance of breast-milk had a pulse of 140 and respiration of 50, the temperature containing from 98°.6 to 99°. Only in some of the cases when a frequency of the pulse and respiration has continued through the second year has the infantile rate been also quick. In other cases this quickness has existed during a few months only, and these times of rapid growth, of which it is indeed a concomitant ; and though, as before mentioned, often associated with other conditions, is of itself no indication of pulmonary disorder.

The normal rate for the first few months of infancy is pulse 120, respiration 40 in the minute. A child, five months old, while at the breast has a pulse of 104 and respiration 26 in the minute; soon after the pulse becomes 120 and the respiration 40, from some disturbing cause other than the teeth; when this is over (three weeks from the first observation), the pulse was 100 and the respiration 25 at least during sleep.

It is not until the child is a year, or a year and a half old that the formula "pulse 100, respiration 24," which prevails from the second to the seventh year, is generally found, and then with the greatest variations; these depend less upon the state of dentition than upon individual peculiarities, as will be seen: a child of a year old (Case 8) with a pulse of 120 and respiration 30, has this rate somewhat diminished (it was reduced to 88 and 20 on one day from diarrhœa) in the next month while cutting two double teeth; another child (Case 9) of a year and a quarter, with only three incisor teeth, has also pulse 120, respiration 30; of two children, each fourteen months old, both of rapid growth, the one (Case 10) forward, the other (Case 11) backward with the teeth, each had the pulse 120, and respiration 40; one of these, a boy (Case 10) at a year and a quarter, when all but the last four molar teeth were through, has pulse 100, respiration 24; another boy (Case 12) of two and a half years, backward with his teeth, has exactly the same, while a third (Case 13), two years and eight months old, with all his teeth, but in a low state of nutrition, has a pulse of 120 and respiration of 30. Case 13 and Cases 8 and 11 had a somewhat low temperature; Cases 9 and 10 had high temperatures, which in the first was sometimes, and in the last, frequently 99°; six months afterwards this child has measles, after which the temperature is low, and the pulse-respiration ratio again becomes 120 and 30 in the minute, and continues so for some weeks.

High temperature and quick respiration are associated with rapid growth. Case 10, at fourteen months, was 33 inches in height; Case 12, up to two years old, had the respiration generally 30 in the minute; he had then grown 2½ inches in less than six months. In this child the respiration, while 24 in the day was still 22 during sleep. Other children, two years old, with a respiration of 22 in the day, have had it 18 in the night; it has been found as low as 15 at midnight in a boy of seven years old.

The nervous system probably exercises an influence underlying all these varying conditions, harmonising all the stimuli both from within and without the individual, and tending, as long as its function is unimpaired, to preserve an equability of temperature amid ever-changing circumstances. The pulse may vary with the slightest exciting causes, and the respiration with the different states of weakness or want in the body, but the temperature remains the same; the great object seems to be that the elements out of which the phenomena of life are being evolved, should be maintained in one constant physical state, of which an even temperature is an important condition. Hence it is that the variations in the bodily temperature become so valuable an indication of disease, in the adult more certain than the variations of the pulse; but in infancy, when the pulse and respiration taken together are even less trustworthy, it is satisfactory to find one condition of the body remaining so far constant (varying only within certain limits, and with certain ascertainable changes in the system) as to be a guide both in our estimate of health, and in our diagnosis of disease.

There is a lowering of temperature after all the acute febrile diseases, and a liability of it to be easily depressed during convalescence; this is owing to the interference with nutrition, as well as the waste of tissue thus occasioned; only those who follow temperature variations carefully can be sufficiently impressed with this truth; it obtains in the slighter ailments of children as well as in the more severe. It is well marked after vaccination, and even after a day or two of infantile diarrhœa. In one such case, occasioned by excess or error in feeding, and not treated by medicine, though the temperature *in recto* never exceeded 99°, there was a lower range of temperature than usual for five days after, with only 98° *in recto* in one of them.

The greatest difference between a local and general temperature met with in infancy has not exceeded half a degree, and this under exceptional circumstances. An infant (Case 14), a fortnight old, on the tenth day after vaccination had secondary pustules on the arm, which kept up much irritation and discharge; the general temperature, fluctuating at this time from a little below 98° to nearly 99°, was easily depressed by exposure, or raised by food; during five days, while the arm was still red and secreting a good deal of thin matter, the temperature in the axilla of the arm affected was higher than that of the rectum; when this was 97°.8 that was 98°.3; and after food, while it was 98°.8 in the axilla it was 98°.3 in the rectum; the descent of the fæces reduced, but did not obviate this discrepancy.

A depression of temperature in infancy is of more immediate practical significance than the slighter elevations, for while it excludes the idea of any acute or special disease existing, it points at once to the condition requiring remedy, namely, bad nutrition. This may occur while the infant is being suckled if the milk be deficient in nutritious quality, as well as in Case 3, when from absence of breast-milk the temperature, once as low as 95°, was kept down to 97°. Even in older children, when suckled for too long a period, or when oatmeal or slops, on the Scotch and French plans, are substituted for milk and bread and butter, the same thing happens: a girl, aged one year and eight months, brought up on the latter plan, has eczema of the head with extensive suppuration of the lymphatic glands of the neck; the temperature nowhere was above 97°. This child had twelve teeth, and some little trouble from them. With milk and cod liver oil she soon got well.

The irritation of teething may have some positive effect in diminishing temperature; this has been found to be low even when there was restlessness at night with a feeling of heat on the head and skin. Flatulence in young infants is a frequent cause of disturbed rest and low temperature. Spasmodic affections, tooth-rash, bronchial râles, and diarrhœa, if from tooth irritation and defective nutrition combined, are found associated with a low degree of temperature. During dentition, croupy attacks closely resembling true croup in all external characters, may thus be at once distinguished and relieved.

In cases of so-called "irritation from teething," when the temperature is much elevated—and this may happen in those suffering from the most defective nutrition—some other cause than mere tooth irritation must be looked for; in this way constipation, catarrh, either of pulmonary or gastric mucous membrane, enlarged cervical glands, slight enlargement of the *glandulæ concatenatæ*, or even otitis may be found; and in these states of system, with great mobility of nervous system, a very high temperature short of disease is quickly reached; 100° to 101° is frequently met with, 102°.3 has occurred, and even 103°; though this quickly subside, and the complication present call for no grave prognosis, it is to be borne in mind that the high temperature, if not enough to cause convulsions, may through exposure or want of care readily lead to some serious complication; indeed, such elevation of temperature as significantly points to the necessity for rest in bed, as does the opposite condition to the improvement of the diet.

In infantile diarrhœa, the temperature taken in the rectum is a valuable aid both to diagnosis and treatment. A child (Case 16), fourteen months old, with sudden diarrhœa and thirst, cutting the lower molars, pulse 100, respiration 20, has a rectal temperature of only 98°. In case 8, though the skin felt hot, and the anus was excoriated from the diarrhœa, the temperature in recto was 98°.6; a little girl, ten months old (Case 17) cutting the lower incisors, has diarrhœa in the morning and cough at night, pulse 140, respiration 40, has the temperature in recto 98.°3. A child, six months old (Case 18), from improper feeding has severe diarrhœa for three or four days; the rectal temperature continues at 99°, once only being 99°.3. Contrasting strongly with these is Case 19, occurring at the same time as the last, in the summer, the child four months old has diarrhœa, not so severe apparently at first, but the rectal temperature was 102.°5, and all the characters of choleraic diarrhœa eventually declared themselves; on the fifth and sixth days the temperature was 104° in the rectum, though the surface was with difficulty kept warm; on the eighth day the rectal temperature was 103°, after which a gradual diminution occurred; the child died on the fourteenth day.* Among the pródromata of cholera albuminuria has been noticed.

In summer diarrhœa the chief element of prognosis is the age of the patient; every attack is dangerous to children in their first half year of life, most so to the youngest. In the numerous cases of serous or choleraic diarrhœa among children occurring during July and August, noting the temperature was of use in estimating the gravity of the seizures, and sometimes in prognosticating recovery. A very delicate infant (Case 15), a fortnight old, with an attack of this kind, had a temperature of 101°, and for three days it was 100°.5 or more; on the fourth day there was a diminution to 99.°2, and on the fifth, though the child seemed as ill as possible, and the returning urinary secretion was much mixed with blood, the temperature being 98°.6 on that day, and 98°.4 on the next, gave hopes of recovery, which the result justified.

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* Mr. Shirley F. Murphy, *Lancet*, vol. 1, 1887, p. 1080, notes raised temperature in cases of winter diarrhœa, traced by him to the use of unwholesome butter.

The high temperature characterising the acute specific diseases is as marked in cholera and diphtheria, except in collapse, as in measles and scarlet fever, and in doubtful cases often becomes a trustworthy agent of diagnosis. In the anomalous cases, likely to arise in all epidemics, some of the doubtful attacks might be recognised by the thermometer which otherwise would be in danger of being overlooked; and it is hardly too much to say that in this way the spread of the disease, and perhaps fatal consequences, have been arrested.

A child one year and a quarter old (Case 20) had been restless for two nights, and had an evanescent eruption supposed to be tooth-rash; the child was running about the room, pale, with no trace of rash, and apparently cheerful and cool; the temperature was 102° on the surface, and in the evening became 103°; the rectal temperature was 104°. Warmth and rest enabled the rash to reappear; there was slight throat affection at first, which afterwards became troublesome, and the illness was not over for two months.

In diphtheria, valuable time is often lost from the first few days of high temperature being overlooked. In scarlet fever the high temperature is so quickly followed by the rash, that the necessary care can at once be taken. In both, the period of illness, as measured by temperature, is somewhat longer than has been stated; in mild cases pyrexia only lasts five days, in some the temperature begins to subside on the surface before the rash disappears, and frequently becomes considerably less when that has faded, yet it may continue to be as high, or higher, in the rectum for a day or two longer, and may not subside till the tenth or twelfth day, after which the existence of certain complications will send it up again. An important point can here be decided by temperature. If no kidney disease have been set up, or be now existent, albuminuria may continue in considerable quantity (apparently from the blood-state alone), without increase of temperature, whereas the appearance of albuminuria has been marked by a considerable increase of temperature, where there has been reason to suspect lesion of the kidney.

The period of incubation for scarlet fever is probably five days; it may be less: the longest period to my knowledge is eight days, in the case which follows. No marked temperature change has yet been detected until the day preceding the rash; there may have been a day or two of heaviness noticed, with perhaps yawning, and even a period of low temperature; just before the more declared symptoms there is excitability or liveliness, sometimes with a return of appetite, and it is often remarked how particularly well the child seems; this, of frequent occurrence before the illnesses of children, marks the commencement of the elevation of temperature. A boy (Case 21), æt. 2½ years, removed from an infected house for a week's quarantine, would, on the eighth morning, have been pronounced unusually well, except that the axillary temperature, hitherto somewhat below, was found to be slightly above the normal; the bowels had not acted with the usual regularity, by night there was a high temperature, and before morning vomiting and diarrhœa, with tenesmus. The rash was fully out by noon, and that evening and next day the temperature of the surface was 101°, with a very full rash. On the fifth day, the skin, though still very red, had a temperature at noon of only 98°, while in the rectum it was 101°, and at night 102°. This temperature, with the same evening exacerbation, continued till the eighth day: the subsidence was nearly complete on the twelfth day, when there remained only coryza.

An evening exacerbation was found throughout the course of scarlet fever. In a case (22), on the eighth day a slight articular affection made the morning temperature 101° and the evening 102°.8; next day these were 101°.2 and 103° respectively. The morning temperature became 99°, and the evening 101°.4 the twelfth day; on the next, these were 99° and 100°.3; on the fifteenth, 99° and 99°.7; it was not till the sixteenth day that a temperature of 98° in the morning, and 98°.5 in the evening, corresponded with an apparent freedom from illness. Sponging the surface during the very height of the rash in scarlet fever has not only proved a comfortable but a perfectly safe proceeding; at this time its effect in raising the surface temperature and in moderating that of the interior, is at least as great as in health. In a boy of six (Case 23) who had been delicate, the axillary temperature on the second day of the rash of scarlet fever was only 99°.1—it had been 100° the evening before—the rectal temperature was 102°; the surface was sponged at eleven a.m., and before noon 101° was obtained in the axilla; the evening exacerbation was moderated by the same means. The rash continued to be quite as red, but gave less discomfort. Where the difference between the surface temperature and that of the interior is great, this method might be more frequently adopted.

Scarlet fever, if not always as severe in infancy, may be thoroughly characterised at an early age. A girl (Case 24), æt. 1½ years, had a full and vivid rash during the first week of illness, slight affection of the ear-passages in the second, and some desquamation of the renal epithelium, as well as of the skin, in the third. The disease, in a severe form, proved fatal to an infant whose sister, æt. 4 years, recovered with the loss of the cervical glands by sloughing; this accident also eventually proved fatal to a delicate girl of five years, who suffered convulsions with the first appearance of the rash.

The highest temperature noted during scarlet fever has been 104°.5, in a boy, æt. 9½ years, on the third and fourth days of the illness; this may have been exceeded during the intervening night, but the next night, when there was active delirium, 104° could not be obtained on the surface. The temperature was 103° in this case till the eighth day, 102° on the ninth and tenth, and in two days more became normal.

In measles a temperature of 104°.5 has been met with just before the height of the rash (Case 25) in a boy of seven years old, with slight delirium, but no other bad symptom. A boy of nine has much nocturnal delirium, with a temperature of 104°.1 in the axilla; this was on the fifth day of illness, and at the height of the rash; the next day there was diarrhœa and a temperature of 101°. Another boy, æt. 12, the third day of illness has a temperature of 104°.6 on the first appearance of the rash; there was diarrhœa, but very slight delirium; a full rash with subsidence of temperature, and favourable progress with great depression of temperature after the sixth day. A boy of five (Case 26) has 103°.5 on the third day, before the rash is fully out; on the fourth, with a full rash, the temperature is 102°.4, quite a degree less than the day before the eruption was complete; the pulse also subsided from 140 to 120; the respirations, 30 on both days, increased to 36 in the minute on the next day, when the temperature continued to be as high as 102°; on the sixth day the temperature falls while the rash is at its fullest, and while still quite red on the seventh day, the temperature is only 98°, the convalescence being rapid and uninterrupted. In the elder boy (Case 25) some râles were heard at the base of the lung on the eighth day during the depression of temperature; these disappeared under the use of stimulants, and recovery was equally rapid.

Convulsions occurring before the appearance of the rash proved fatal to a weakly boy six and a half years old. He is ill, and complains of his throat; on the second day the temperature is 104°.5, the convulsions begin towards night; next day death comes before there are any signs of the eruption. A sister, older, and two brothers, younger, go through measles favourably in the same house at the same time; six months after they are all carried off by diphtheria.

Convulsions occurred on the appearance of the rash, with recovery, in a stout boy one year and eight months old (Case 10) when convalescent from whooping cough, and troubled with the last four molars at the gum. Measles having broken out in the family, this child was removed from the house, carefully isolated, and watched. Ten days afterwards a slight elevation of temperature (99° in the axilla) was noted at night; by morning this was 100°, the cervical glands were perceptibly enlarged, the child was sickening, and was restless at night; this would have been called the first day of the illness. On the next day, the second, there are spots of rash behind the ears and on the shoulders, the temperature is 102°.6. On the third day, at eight a.m., the rash is full upon the face, at noon the body and legs are covered; once during this day the temperature reached 104°, the exact time of this observation not being recorded. Convulsions occur at two p.m., afterwards the rash is paler; next day the temperature is only 99°, but the day after it is again 102°; and though the disease may have been interrupted at its height by the convulsions, this increase of temperature was aided by some amount of pulmonary congestion, which continued through the following day. Convalescence was satisfactory with a low temperature, which was 98° on the ninth day, and afterwards still lower, the pulse and respiration being accelerated and reverting to the infantile type for some weeks. (Twenty years after a transverse line on the front incisors of the subject of this observation, now a tall man, marks this momentary check to nutrition.)

Measles possibly becomes contagious before the characteristic lesion of the skin is established. The skin, instead of being as in scarlet fever among the earliest tissues to be affected, shows signs of the disease after the implication of the conjunctival, the pharyngeal, and schneiderian membrane, and not always before that of the larynx and bronchi. A little girl, six years old, the sister of the infant last mentioned, who was removed at the same time, (November 5th) has coryza a day or two without attracting much notice, and has more marked symptoms of measles one day earlier than he (November 14th), when she is sick in the morning and delirious at night; the spots appearing but faintly on the 15th. The temperature is 103°, the rash abundant. On the 16th, temperature 102°, the rash quite as full; 17th, temperature 99°.2, the appetite returning; the pulse 104. It was 140 on the 15th; respiration at the same time has advanced from 30 to 34 in the minute; there are some bronchial râles, the breathing continuing to be slightly accelerated, and the temperature a little above the usual for a day or two longer. Had the first symptoms been attended to, and the child sent to bed a day or two earlier, it is fair to expect that the ailment would have passed off more easily. Her elder brothers, who had measles, were much with her before the separation, which was effected on the day that they first showed the eruption; whether she caught it from them before the appearance of the rash or no, it is clear that the elder brothers caught the complaint from a boy who had not then the completely developed disease. The two brothers (Cases 25, 26) attended a day-school where this boy resided. He was dull, and kept in the class-room with them on Thursday, October 22nd; they were absent from school the two following days, and on their return, Monday, October 26th, were at once sent home because this boy was in bed with measles. On October 31st the eldest brother is seized with vomiting, but is better next day, when both boys take a long walk and seemed tired.

On November 2nd the younger had fever and restlessness in the night, and some spots appeared on the face which were not visible next day, November 3rd; the temperature also subsided to 98°.4 in the axilla, but the pulse remained accelerated; both have the rash out on November 5th, and it is at its height on the 7th—the thermometric crisis occurring a day earlier in the elder boy. This is twelve days from the visit to the school, and as they were in the same class room it is probable that they contracted the disease from him a day or two before.

Another case of this kind occurred at an excellent day-school under my observation. On March 2nd, 1868, a boy seemed dull at his lessons, and was kept in the class-room throughout the day instead of going home to his dinner as usual; the next day he stayed at home, and on the 4th was known to have measles. Many of the younger boys, from eight to ten years of age, who used this class-room, were either away ill or noticeably ailing on March 12th; one boy who only seemed dull at his lessons on that day had the rash appearing on the 14th, and on the 16th it was at the height.

When exposure to the source of infection is more continuous a shorter time suffices for the development of the disease, and the period of incubation is then closely approximated to that necessary for the evolution of the rash after inoculation. Exactly this period (seven days) elapsed in one case, where a delicate girl (Case 28) was brought into its midst. This was on January 24th, 1865; on the 26th there was headache, a slight elevation of temperature, no alteration of pulse; 27th, pulse quickened, elevation of temperature not so marked, conjunctivæ reddened; to keep in bed; 28th, throat red, small spots on temples, does not feel ill; 29th, the spots are slightly raised, not more numerous and not red, restless at night, and temperature higher; 30th, appearance of rash on the face and neck; 31st, rash characteristic, face swollen, chest and body generally spotted, arms and legs as much clear skin as coloured; February 1st, still red, temperature normal, no after consequences. The favorable progress of this case was probably owing to rest in bed during the early stages. Could the signs of ingress always be noted, some of the uncertainty in the appearance of the rash from the first to the sixth day of illness, and as to whether the disease declines on the fourth or seventh day, now found in the best accounts of the disease, would be removed. Moreover, the want of an earlier recognition is the great cause of the spread of the disease. In measles the ailment is frequently well nigh over before it comes under observation. Nearly a fortnight may elapse from the time of exposure to the fully-developed rash. The first temperature change may not be noticeable till five or six days after exposure to infection; then there remain seven days of illness, only five of which are markedly pyrexial. The thermometric crisis occurs just as the rash is at its height. Complication may delay the crisis and keep up the temperature for a few days; the sequelæ are associated with the subsequent low temperature.

Small-pox by inoculation is produced on the eighth day with a further eruption two days after; taken by infection it does not appear on the skin till the fourteenth, after two or more days of sharp illness. In one case of a young girl elevation of temperature was noted four days beforehand; this reached 105°.2 the evening before the rash was thrown out. The illness proved fatal.

Vaccination; after a temporary depression of temperature a continuous rise commences on the fourth and fifth days; this suddenly increases on the eighth day, and as suddenly falls on the ninth; afterwards the local process may continue active, but the disease is over. There is, too, a tendency to a low temperature afterwards, and this actually accompanies any subsequent eruption, such as the vaccineous roseola.

Varicella once only has been known to begin with convulsions, and this in a weakly boy four years old; the convulsions occurred on the day preceding the eruption; there were no other bad symptoms. An initial temperature of 104° has occurred before the eruption, with a fall on the first appearance of the spots; then a gradual rise for three days, as is usual, while the vesicles increase in number. The pyrexia in this disease is sometimes very slight at any part of its course; but it often attains a considerable elevation before the eruption is completed; 104° was reached on the fourth day in a robust girl aged fifteen years. A healthy, strong lad, twelve years of age, after two or three days' feeling of illness, is found with a temperature of 102°, which increases at night and is attended with delirium; the next day some spots of varicella appear; on the third day they are numerous on the back and belly;

the temperature in the axilla was at or near 99° from this to the eight or ninth day, the spots continuing to be red; some of them dried up on the seventh day, when there was slight conjunctivitis; on the tenth day the spots had disappeared; the usual depression of temperature followed; on the eleventh day only 95° could be obtained in the axilla; the thermometer kept under the tongue with closed lips for two minutes only reached 97°.5. One case of varicella with persistent irritation round the spots, had a temperature of 99½° at the end of the third week; neither in this case nor in some with gangrenous sequelæ did the history of infection point to variola rather than to varicella, though the cases on either supposition must have been anomalous.

Mumps comes on with a marked elevation of temperature; it has been found as high as 103° in a child (Case 29) 1¼ year old, just before the greatest swelling of the parotid; there is often a subsidence of temperature by the time the child comes under observation or shortly after, the swelling continuing after the fever (sometimes very slight) is passed; so that sometimes a boy will complain, with reason, that this is worse than other of his infantile disorders, in that he feels hungry but cannot eat. The period of incubation is a long one, probably a fortnight.

Whooping-cough presents more difficulties in tracing thermometrically: its period of incubation may be nearly seven days. A girl, æt. twelve, returns home July 25th, while her five younger sisters all have whooping cough. On August 2nd she has large bronchial rhonchus and the whoop. The diagnosis of whooing cough in its early stage from influenza or bronchitis in children must be always difficult. There is the same elevation of temperature, and the only point of differentiation to be offered provisionally, is the undue excitement and quickening of the pulse in proportion to the respiration; this point, common to all diseases of the class, may be noticed before, or sometimes with the first cough, often long before the first whoop, and at the same time a rise of almost a degree of temperature may be noticed. The small glands at the sides of the neck are also enlarged so as to be felt along the sides of the trachea, and behind the sterno-mastoid; but these may be noticed in other catarrhal attacks; a greater prominence of cervical glands occurs in measles, rubella, and in varicella; in scarlet fever, diphtheria, both true and false, and allied throat affections, the glands at the angle of the jaw are palpably enlarged and tender. Purpura and some other dyscrasiæ quicken the pulse, but do not elevate the temperature. Bronchitis, which elevates the temperature, unduly accelerates the respiration. Whooping-cough is also attended with a quickened respiration after the first day or two of illness; when the disease is fully established any rise of temperature then occurring must be referable to pulmonary complication; in every case where this has been noted it was owing, and in proportion to, the lesion of lung present. These are often in irregular spots.

The unequal character and diffusion of the pulmonary signs is often a guide to whooping cough in its later phases. When there is much impediment to respiration convulsions are imminent, and it is not too much to say that convulsions so frequently fatal in whooping cough are mostly owing to the pulmonary implication. There may at the time be a greater elevation of temperature than the state of the lung generally produces, but for the relief of this condition, it is the respiration and not the nervous system that is first to receive attention.

A child (Case 30), eleven months old, eight or ten days with whooping-cough, is suddenly febrile, with increase of cough at night, and short breath; next day convulsions occur; a leech-bite on the temple had been bleeding some hours when the child came under observation; there was great pallor, and the fontanelle was depressed. Pneumonia, not far advanced, existed in the left lung. Before giving an enema of weak extract of meat and brandy, the temperature in the rectum was found to be 103°.6; next day the temperature in recto was 104°, the day after 103°, after which the pneumonia disappeared; the chest-walls were not collapsed; and now, though the respiration was relieved, the convulsions would sometimes continue for more than an hour. It was noticed that a convulsion took the place of a whoop, and was kept up by spasm of the glottis. The child was then held face downwards over a basin, cold water poured on to the nape and vertex, air was soon drawn into the chest, mucus expelled from the mouth, the attack thus cut short, and the child made a good recovery.

A parallel is again here noticeable between the convulsions produced by this condition in the infant, and the delirium so constantly met with in the adult, where there is either sudden congestion of the lung or pneumonia.

The great loss of blood in the above case did not affect the pneumonia, though in its early stage; and what is still more worthy of note is that it did not in any way tend to reduce the pathognomonic temperature; indeed, this was quite as high as usual, though at the same time the systemic vessels seemed nearly exsanguine.

There is one form of catarrh essentially infectious, which comes on with an elevation of temperature; this, often amounting in young children to 100°, before any complication, except slight enlargement of the cervical glands, can be detected, has been found associated with influenza, and herpetic sore throat in different members of the same family, and is difficult to distinguish at first from the onset of the exanthemata or of whooping cough. In these diseases the use of the aqueous sulphurous acid in spray is to be recommended. Next to the power of a more early recognition of infectious diseases, some means of arresting them in their earliest stage is necessary to their extirpation.

The spasmodic cough, occurring at night in children of low nutrition, or suffering from teeth, is readily distinguishable by the low temperature from the ingress of whooping-cough—a point of some importance among young children.

Thrush, or muguet, has been found associated with either extreme of temperature; in the one condition (Case 3) pointing to the want of suitable nutrition, with a good prospect of recovery, which would be less hopeful were the temperature to rise; in the other the prospect of recovery varies with the nature of the illness and the condition of the patient. At the commencement of a malady (Case 31) its presence need not prejudice the prognosis, and points then, as in cases where but little temperature change is met with, to the removing such articles of diet as the child cannot digest, and to the neutralizing the acid state of the mouth existing, when the vegetation and increase of the *Oidium albicans*, of which the white spots consist, is interrupted. Borax or other weak germicide is also useful.

Bronchitis may cause an elevation of temperature to 100°, and reduce the pulse ratio below three to one. In children over two years of age the pulse and respiration ratio may, as in adults, be a guide to pulmonary congestion or pneumonia, of which latter state the ratio of two to one is no doubt pathognomonic; but in infants, little more than the extreme disturbance of this relation can be made out. Besides the physical signs of these disorders, we have for our guidance the greater elevation of temperature which, if a small part of the lung tissue be implicated, will often rise to 103°, or higher. In lobar pneumonia, not infrequent in children, 104° or more precedes the local lesion, it may be for two days; this high temperature subsides somewhat suddenly before the pulmonary effusion disappears. A high degree of temperature may exist for a day or two in idiopathic croup. In croupal diphtheria the temperature may or may not be so high, but it continues near 100° for a much longer period, possibly to the tenth or twelfth day, even in extreme conditions of apnœa.

Meningitis in an infant four months old, had with the earliest convulsive twitches a temperature of 100°; this was 101° before evening, next morning it was 103°.6 in the axilla, and increased to 104°; death on the third day.

In taking these observations, it is necessary that the thermometer should have a small bulb, and that it should be completely covered by, and in contact with, the surface where it is applied. Except in very young infants the axilla is the most convenient place, and the thermometer is best introduced from behind; on raising the arm two axillary folds are seen; the thoracic one should receive the bulb of the instrument, and the arm be then turned and held down for two or three minutes; in this way a temperature may often be obtained within half a degree of that of the interior of the body. In the folds of skin around the neck of a well-nourished infant a similar result may be obtained; indeed, a fold of skin sufficient to cover the bulb of the thermometer at any part of the surface which has not been unduly exposed, will afford useful indications. A thermometer placed in the mouth of a young child with teeth, and withdrawn too quickly for the full degree of heat to be registered, often affords useful information by the readiness with which a rise is obtained, and this even has a diagnostic value.

In conclusion, it is hoped that these observations may have a practical relation to the health of children, and that this method of observing may prove a definite aid to our means of investigating their diseases; while the facts brought together may not be without value, as affording elements of comparison, to other observers.

Most of the foregoing observations, published under the title "Infantile Temperatures in Health and Disease," by Messrs. Churchill, have long been out of print. As this and a paper on the same subject, read before the Obstetrical Society in 1868 (Transactions, Vol. X.), include children up to twelve years of age, and as now a case of varicella in a girl fifteen years old is admitted, the title of this reprint is changed so as better to indicate its scope and purpose. That temperature changes afford the same indications in children as in adults may now be considered as established.

Dr. Sturges, whose great experience and careful work, both at the Great Ormond Street and the Westminster Hospitals, are as well-known as his independence and sound judgment, has kindly forwarded to me, with permission to make extracts, a reprint from Vol. II. of the Westminster Hospital Reports, of his valuable lecture on "The Temperature of Young Children," given at the Hospital for Sick Children. Besides observations taken every three or four hours during illness and convalescence, and hourly in some cases, this paper describes a series of forty observations made on two robust boys of one and two years old respectively, living in the country, which give a perfect thermometric picture of health; the readings were taken in the axilla at various hours from 10 a.m. to midnight. No reading was over 98°.6, and only once in exceptional circumstances of fatigue was it found as low as 96°.8. The usual range was from 98°.6 to 97°.4, representing 1°.2, but occasionally the lowest (evening) temperature was 97°.2. It happened repeatedly with both children that after a reading of this sort had been taken on going to bed tired, a second trial at midnight, and after some hours of sleep, found the temperature risen and near 98°. Dr. Sturges remarks:—"It is possible, however, and indeed likely, that the inferior limit of heat has been sometimes missed, because early morning readings are wanting." The following conclusions are those of the original observer of these two children.

1. The body heat may be said to range between 97°.3 and 98°.6. The elder, two-year-old child, who can run about, has a more uniformly low temperature than the younger, who is one year old, and can only stand. At the same time the two have often precisely the same temperature to a decimal point.

2. The highest temperature is undoubtedly reached after

breakfast, say 10 a.m., when the child is "fittest," satisfied with a good meal, and eager for play.

3. In the hottest weather of an evening the readings were uniformly low (97°.3 or thereabouts).

Having before illustrated the *instability* of convalescent temperatures, and the ready depression in children, the lecturer continues:—"To sum up, making allowance for errors in detail, the broad conclusion is, not that the normal temperature of young children differs from that of adults in range or in height, but that it is less stable, disposed to take dips or flights, and that when disturbed it takes a far longer time to settle down. If, therefore, an equable body heat is the true test of health, it is obvious from what has gone before that in the case of children a period of very uncertain duration intervenes between apparent recovery and full recovery. And if that be so, it is probable that we have in the thermometer, as yet unrecognised, an instrument of precision of the greatest value, and which has been long needed in the interest of childhood. It is a familiar experience that with these subjects trivial ailments leave grave liabilities. Some of the commonest morbid changes of early life—enlargement of bronchial or mesenteric glands, destructive lung mischief, the development of tubercle—take their origin very insidiously after measles, or whooping cough, or pulmonary catarrh. It may be, I say, that this variability of temperature, which so remarkably distinguishes convalescence in young children, is the very sign we are in want of, and that the return of the child's body heat to a normal and equable level furnishes a nicer test of immunity from such sequelæ than any we use at present. So much for the temperature of health and of convalescence. How is it with disease? It seems strange that with the introduction of the thermometer to measure pyrexia no more precise *method* of use should have been laid down than that which is implied in a morning and an evening reading. What *is* morning and what evening in this matter? The highest temperature of the day, as we have just seen, may happen at 10 a.m., and habitually the lowest is some four or five hours earlier. A morning and evening reading, therefore, may be so timed as to exhibit no variation at all for the twenty-four hours, notwithstanding that the actual variation has been considerable. Add to this that with pyrexia—and especially the pyrexia of young children—the highest and the lowest diurnal register may fall indifferently at any hour of the day or night, so that the utmost vigilance of observation may fail to catch it."

A diagram is given of the pyrexia of an infant under a year old, in a rare instance of fatal lobar pneumonia at that early age. Twelve observations were taken for one day, viz., from 4 a.m. to the following midnight; twice there is a sudden fall, and the actual range of temperature for the one day exceeds 4°. "But," he says, "if the observations had been taken at 8 a.m. and either 6 or 8 p.m. and no more, as is customary, the variation for the day would have been hardly appreciable. On the fifth day, after the fall here depicted resembling that of recovering crisis, the child died."

I make two more extracts from near the end :—

"Temperatures may sometimes be distinguished as bad by this criterion; they are not high, they have no great range, but they vary much, and are highest at midnight and in the small hours."

"The pyrexia is good, *cæteris paribus*, which is lower in the morning than in the evening; which is equable or with but slight variations from day to day; which has a single rise and a single fall in the twenty-four hours; and whose lowest morning level approaches the normal line. The pyrexia is bad, *cæteris paribus*, which is highest in the morning; which ascends from evening through the small hours; which has two or more rises or falls for one day and night; which either maintains its level above 103° pretty equably for many hours together, or else is very variable from day to day, and conformable to no pattern. Add to this—what was early known, yet what of itself would suffice to save the thermometer from ever falling into neglect—that the temperature register gives the first warning of impending mischief after injuries and surgical operations; that it supplies our sole means of watching and of measuring hyperpyrexia; and that, in conjunction with other signs (by no means of itself), it helps to distinguish certain fevers and to estimate their progress and severity."

TEMPERATURE VARIATIONS IN THE DISEASES OF CHILDREN.

In prosecuting the investigations on the temperature-changes characterising the disorders of infancy, a large number of observations have accumulated, some of which may now conveniently be brought together, arranged, as much as possible, in the order that has guided me in this inquiry.

The object, foremost in my view, has been to gain a more definite idea of the natural history of the states of disease to which children are specially liable, and to illustrate the more leading features of the most marked and common forms of the acute specific diseases. As a consequence of this it is hoped that some addition may come to our certainty in diagnosis, and especially to our power of identifying at the outset those diseases most requiring early recognition. This is important, not only in the treatment of the individual, but for the protection of other members of a family and the community at large. There are also considerations of therapeutics and of hygiene which naturally follow, and are not unconnected with the line of observation pursued.

In some of the exanthemata the development of the eruption is followed by a fall of temperature, in others the temperature at this time does not show the same tendency to fall. Measles and scarlet fever being taken respectively as representatives of these two classes of disease, it may be remarked that in the one there is generally a long incubative period, while in the other this is generally short; in fact, the skin is the first tissue in the latter disease to be affected, though by no means the last, while in the former, as is well known, a catarrhal period of considerable severity, and of three or four days' duration, precedes the eruption.

In a previous paper instances were given to show the probability of the pre-eruptive period in measles being infectious; positive evidence of this can now be adduced, with observations showing that this period is not without temperature changes sufficient to give warning of the danger of infection, before the rash, which in scarlet fever is warning sufficient, has had time to appear.

The temperature-changes for the initiatory stages of measles are given in the accompanying tables. These, and some others which follow, are of interest as indicating:

(i) By alterations both of pulse and temperature, an excitement of the system caused by the presence of the poison;

(ii) By a well-marked depression of temperature, the point from which the commencement of the disease may in reality be dated;

(iii) The special series of temperature-changes characterising the particular disease present.

TABLE 1.—*Pre-eruptive stage of measles. Morbilli.*

A girl, æt. 5 years, exposed to infection March 30th, cough on April 2nd.

Days of illness.	Date.	Pulse.	Resp.	Temperature in axilla.	Remarks.
4	April 3	110	26	98·6° noon	Slight cough and coryza.
3	„ 4	120	32	99·4° „	Eyes red, tonsils full.
2	„ 5	120	30	100·7° „	Doubtful mottling of parts of skin.
1	„ 6	104	30	99·0° „	Face mottled.
0	„ 7	100	26	97·3° „	Skin clear, slight cough.
1	„ 8	110	26	99·2° „	Respiration weak, a wheeze on forced inspiration.
2	„ 9	130	30	100·3° „	Ill, but not in bed.
3	„ 10	130	40	100·5° „	Respiration clear; spots of measles visible.
4	„ 11	...	...	102·0° „	Rash; purulent secretion from the conjunctiva.
5	„ 12	...	...	... „	Rash fully out, eyes better.

A boy, æt. 4 years, exposed to infection March 30th.

Days of illness.	Date.	Pulse.	Resp.	Temperature in axilla.	Remarks.
1	April 9	120	30	98·6°	Looks ill, frequent spasmodic cough.
2	,, 10	140	35	101·3°	No rash; wants to go out.
4	,, 12	...	...	102·6°	Spots appearing on temples, cheeks, and behind ears.
5	,, 13	...	...	103·0°	Full dark rash, face swollen; frequent vomiting.
6	,, 14	...	...	...	Defervescence; some desquamation in the following week.

An instance of measles being infectious before the eruption is given in the following case:

A child on a visit, leaves February 13th with symptoms of illness, but no signs of measles till the 15th; a girl, æt. 10 years, had slept with this child from the 9th to the 13th, and remained at home after her visitor had left; she seemed ill on the 20th, had chorea on the 23rd, with epistaxis in the evening, temperature 101·4°; rash of measles on the 24th, croupy cough at night, temperature 103·6; full rash on the 25th, croupy cough and tracheal sifle, temperature 104°; next day the temperature is only 98·7°.

Table 2.—*Morbilli.*

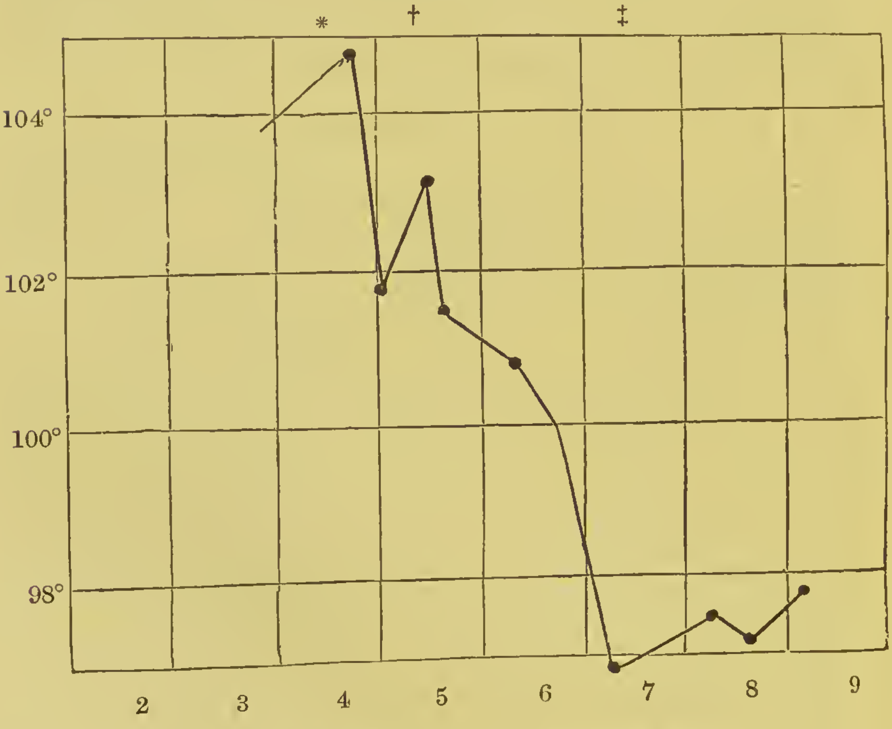
Case 1.—A boy, æt. 12½ years, exposed to infection March 20th, did not appear to be well on the 26th.

Days of illness.	Date.	Pulse.	Resp.	Temperature in axilla.	Remarks.
2	March 27	..	...	...	Cough.
3	,, 28	...	...	...	Ill, with hoarse cough.
4	,, 29	130	40	104·5°	Well-marked rash; delirium.
5	,, 30	130	40	101·6°	103° at 5 p.m. after wine; diarrhœa, 101° only at night, with very full rash.
6	,, 31	100	36	100·6°	Rash at fullest and darkest, slight cough, no diarrhœa.
7	April 1	108	36	96·8°	Rash less intense; râles at both pulmonary bases.
8	,, 2	96	32	...	Hoarse cough, appetite returning, takes wine.
9	,, 3	74	24	97·6°	Less cough, râles audible on forced inspiration.
11	,, 5	...	...	...	Seemed to be well; parotitis occurred on April 9.

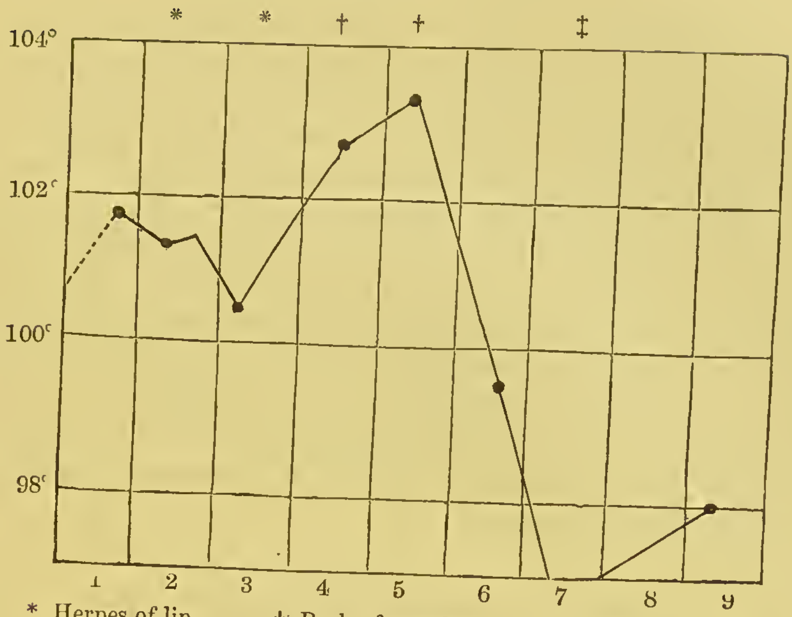
Case 2.—A boy, æt. 6½ years, was with the boy whose case is last given from March 26th to March 30th.

Days of illness.	Date.	Pulse.	Resp.	Temperature in axilla.	Remarks.
1	April 5	120	40	101·8°	Does not feel ill; conjunctiva red, tonsils full.
2	,, 6	100	40	101·5°	Small red spots on lip and cheek.
3	,, 7	110	30	100·5°	Herpes of lip and cheek.
4	,, 8	130	40	102·6°	Seems ill; rash of measles at night.
5	,, 9	130	50	103·3°	Full rash on face and shoulders.
6	,, 10	120	30	99·5°	Body covered with rash; perspiration.
7	,, 11	...	...	97·4°	Tongue furred; some bronchial râles.
9	,, 13	...	...	...	Convalescent; no râles.

These two cases may be represented in diagrams thus:



* Rash of measles. † Wine given once.
‡ Bronchial râles, wine repeated.



* Herpes of lip. † Rash of measles. ‡ Bronchial râles.

Parotitis.—Mumps is the most nearly related to measles of the acute specific diseases. The period of incubation is even longer; a fortnight generally passes between exposure to infection and the full development of the disease; and where no attempt has been made to obviate sources of infection, or where the child, after mumps, has returned to the family too soon, an interval of two months has been known to elapse between the one case and the next: this, however, is the longest that has come under my notice.

Under my observation, the interval from complete separation from all sources of infection to the first symptom of disease has been nineteen days, though the time passed in that instance after the greatest exposure to infection was twenty-two days. Exactly this time elapsed from removing a child with mumps, who had been three days in the house, before a servant remaining in the house felt the first symptom of the disease.

The whole of this intervening period has not been occupied by temperature-observations. Occasional fainting, and a feeling of weakness occurred in a delicate girl for nearly three weeks before mumps was declared. Once, on a wound showing, an indisposition to heal in a general healthy lad, mumps appeared at the fortnight end. In some cases symptoms of illness have been noticed for more than a week before the swelling of the glands. For a week or more after exposure to infection there is seldom any evidence of disturbed health, the feeling of illness being generally confined to the day preceding the swelling. Infants do not take the disease as readily as older children. It may, however, be well characterised at the age of a year and a quarter, and in the case of one child still younger (who had, however, completed his first year), and who was much exposed to infection in a large nursery of children, the following temperature-observations were for a week taken consecutively before any signs of mumps could be detected.

TABLE 3.—*Pre-eruptive stage of Mumps.*

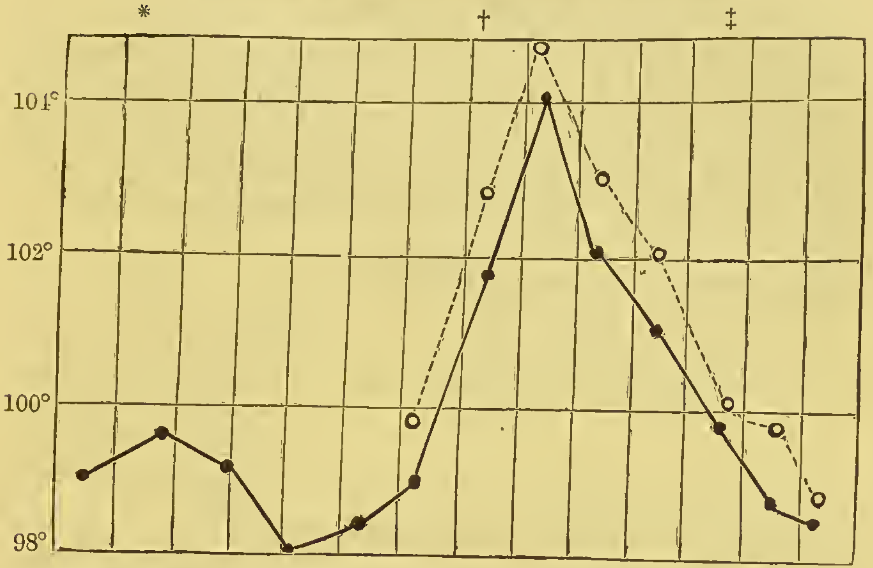
CASE 1.—A boy, æt. 1 year.

Day of illness.	Date.	Temperature.	Remarks.
—3	April 7	99·0° axilla	Two upper molars at gum, red spots on arm.
—2	„ 8	99·5° „	Small spots of herpes or strophulus on arm.
—1	„ 9	99·2° „	Seems well, no other spots on skin.
0	„ 10	98·0° „	
1	„ 11	98·6° „	
2	„ 12	99·6° „	Excitable.
3	„ 13	101·8° „	Vomited; parotid glands first perceptible.
4	„ 14	104·7° *in recto* at night.	One submaxillary gland affected.
5	„ 15	102·0° axilla	Seemed ill all day.
6	„ 16	101·0° „ 102 *recto.*	
7	„ 17	99·6° „	Some swelling of both sides of face.
8	„ 18	98·6° „ 99·7° *recto.*	Herpetic spots near left ear.

Point of left upper molar at gum and corresponding gum on right side full, both gums lanced; child well.

Of these fourteen days of pyrexia, the first three and the last two were probably owing to the teeth; there were, however, five days consecutively febrile, and it was not till the third of these that the child obviously had mumps.

This case is thus represented in diagram.



* Tooth rash. † Enlarged parotid. ‡ Tender gums lanced.

The dotted lines in this and a subsequent diagram represent the temperature *in recto.*

In this case, what might be the import of that temperature nearly of 105°, had it not been known that the poison of mumps was maturing in the system and would probably be cast off with no greater accident than a special irritation of certain fibrous and glandular structures? and is it not evident that the special affection of these glands is the final result and consequence of the illness under notice, and not the cause of the illness? It has seemed that in some cases the salivary secretion, as well as those of the mouth and throat are deteriorated; not only is there a peculiar odour from the mouth but ulceration at the orifice of the salivary duct has been noticed in the course of the disease. Personal infection may persist for a month after recovery from mumps. It is, moreover, probable, though the infection may be greatest at the temperature-crisis, in acute cases showing a similarity to measles, that mumps may also resemble measles in being communicable before the characteristic signs of the disease are obvious.

TABLE 4.—*Mumps.*

CASE.—A boy, æt. 13 years, at home for the Michaelmas holidays, exposed to the infection of mumps at school, had not seemed in his usual health since he left; he became easily tired. On October 1st, after a long walk, had headache, and again on October 5th, from no assignable cause.

Day of illness.	Date.	Pulse.	Resp.	Temperature. Morning.	Temperature. Evening.	Remarks.
1	Oct. 6	...	...	...	...	One side of throat tender, and neck stiff.
2	„ 7	100	24	101·2°	103·0°	Left parotid and right submaxillary glands enlarged; bowels open; urine free; delirious at night.
3	„ 8	110	27	102·4°	102·4°	Face swelled, eyes red, vomiting; better at night.
4	„ 9	84	26	100·2°		Swelling of parotid less hard, no pain.
5	„ 10	68	24	98·4°		No swelling of parotids, a little of left submaxillary.
15	„ 20	...	...	...	...	Quite well, had felt weak till now, no relapse.

A boy at home ill with measles on April 1st, has mumps on April 9th; four younger children, who are in the same room from the 5th to the 9th, take the complaint from him.

CASE 1.—A girl, æt. 11 years, not having looked well for a day or two is restless at night, and has pain under the ears on April 22nd.

Day of illness.	Date.	Temperature. Morning.	Temperature. Evening.	Remarks.
2	April 23	100·0°	101·0°	Swelling of both parotids, and pain.
3	„ 24	98·8°	...	Much swelling, pain relieved.
4	„ 25	97·2°	...	Glands still painful.
5	„ 26	...	...	Nearly well, perspired at night.
8	„ 29	...	...	Not febrile; submaxillary glands affected.

Case 2.—A girl, æt. 9 years, who had not looked well for nearly a week, is slightly febrile on April 22nd, has signs of mumps on the 24th.

Day of illness.	Date.	Temperature.		Remarks.
		Morning.	Evening.	
1	April 23	...	99·4°	Slight swelling of both parotids, right most.
2	„ 24	100·7°	100·9°	Face flushed, left eye pink; severe pain.
3	„ 25	98·5°	...	Great swelling of both sides; is hungry, but cannot eat.
4	„ 26	97·7°	...	Great redness and swelling.
5	„ 27	..	...	Swelling less, redness persists.
6	„ 28	...	...	Epistaxis.

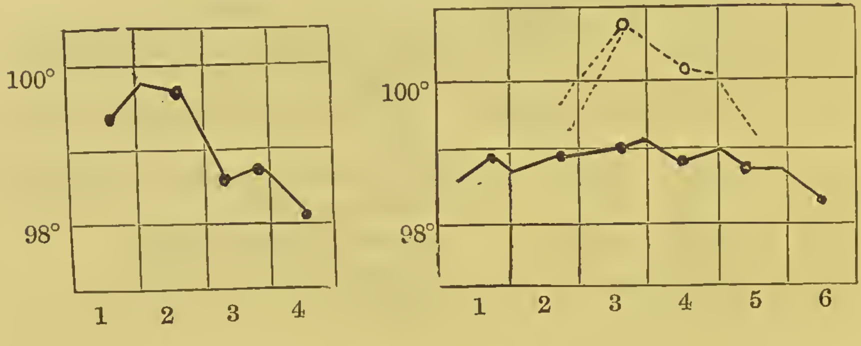
Case 3.—A girl, æt. 8 years nearly, exposed to infection of mumps on April 9th, has the right parotid perceptibly enlarged on April 23rd, with no complaint of illness until awoke in the night by severe pain, she is languid in the morning and excitable, but not ill at night.

Day of illness.	Date.	Temperature.		Remarks.
		Morning.	Evening.	
1	April 23	98·2°	99·6°	Severe pain in the night.
2	„ 24	99·2°	98·6°	One parotid tender, the schlerotic of one eye pink.
3	„ 25	98·5°		Both sides swelled, severe pain in right ear, chloroform given.
4	„ 26	97·1°		Pain on left side.

Case 4.—A boy, æt. 6¾ years, same exposure to infection, had swelling of the right parotid on April 25th with a temperature of 100°, pulse slightly quickened, respiration not affected, no complaint of illness, is sent to bed; April 26th no pain, not much appetite, temperature 100·7°; next day there is swelling commencing on the left side, no pain, pulse 100; respiration 24; temperature 99°. There was considerable swelling during the next three days, but no pain and no fever.

When separation and isolation have been carefully carried out, it has seemed that a milder course of the disease has followed, at least when the health of the child was not defective.

Diagram of two mild cases of parotitis.



A little girl, five years old, was sent from home on March 14th, because her brother came from school on March 11th, with an illness which proved to be mumps; on March 28th she felt slight soreness of throat in eating her dinner; by night the right parotid was swelled and painful, temperature 99·4°. 31st.—Pulse 80; respiration 20; temperature 98·2°; and though some swelling might be noticeable for nearly a week, no subsequent febrile disturbance could be detected. A younger brother three years old, who went from home at the same time to another house, was first noticed to be amiss on April 2nd and was restless at night; 3rd, complained of throat, swelling doubtful, febrile at night; 4th, both parotids palpably affected. Pulse 120; respiration 18; temperature in recto 100·6°; axilla 99°; but neither in the mouth nor at the sides of the neck could a temperature of 99° be obtained; 7th, submaxillary slightly affected, temperature 98·4° axilla.

This child was subject to sudden rises of temperature from apparently trivial causes; he suffered severely with both measles and whooping-cough, and might have been expected to show considerable temperature disturbance in this complaint, had he not had the benefit of change of air and excellent hygienic provision. He subsequently afforded an instance of the positive lowering of temperature on the day before the appearance of the eruption of varicella.

In several cases a higher temperature has been obtained at the neck or in the mouth on the side affected than in the axilla, affording a fallacious support to the idea that the general temperature, and so, inferentially, the general disease, was excited by, or was a consequence of, the local lesion: the case first given, and this last case, afford strong evidence the other way. If the febrile excitement be not to a high degree, the general temperature is not always readily obtainable in the axilla; even in the last case the axillary temperature, though in excess of that in the mouth, was a degree and a half below that of the rectum. It may be generally stated that the local temperature will not be found to be in excess of, or even equal to, the general temperature, if that can be effectually obtained.

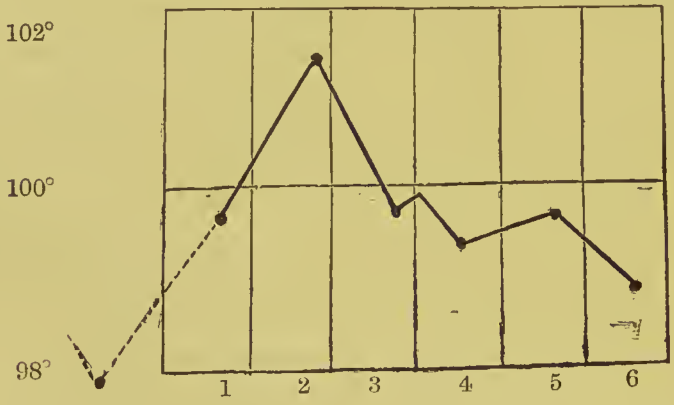
A wave of low temperature preceding the development of many of the acute specific diseases, for which priority of observation may be claimed, has been demonstrated in the early stages of measles, mumps, varicella, vaccination, and whooping-cough. This period of depression does not coincide with the chill or rigor ushering in most acute diseases, for that occurs only when a considerable elevation of temperature is already established, while this is prior to the rise of temperature excited by the progress of the disease. Up to this time it is conceivable that the poison of a disease might be thrown off harmless from the system, and the process of infection might be interrupted, but not afterwards. This puts a period to the true incubation stage, and marks the commencement of what is generally called the stage of invasion, but which ought strictly to be considered as part, and a most essential part, of the disease itself.

The early recognition of this stage is insisted on as of practical importance both for the safe conduct of the patient through the disease, which though now impossible to avert is more easy to manage, and also for the safety of others in guarding them against infection before it is too late.

Varicella.—In chicken-pox the rise of temperature accompanies the first appearance of the spots, and falls after the eruption is developed though it is somewhat elevated as long as any fresh spots appear. The illness precedes the eruption by a few hours only; generally it is indicated by some papular red spots as soon as the illness is felt, and it has but once occurred to me to find any elevation of temperature without also finding some indications of the eruption. Observations made during the period intervening between exposure to infection and the appearance of the disease have afforded no more marked result than that the positive lowering of temperature, occurring at the commencement of most of the acute specific diseases, is here noticed on the day which precedes the more characteristic signs of the disease. Some symptoms of illness, such as pallor, and increased frequency of the pulse, may be at the same time noticeable.

The incubation period of varicella may be given as ten days; it is at least, eight or nine days, as stated by Heberden; and at most, a fortnight or even seventeen days, as stated by Trousseau, may elapse from the beginning of infection to the appearance of the disease.

TABLE 5.—*Varicella.*



CASE 1.—A girl, aged 8 years, attending a day school, is seen with a characteristic spot of varicella on the upper lip, with others in the throat; she remained at home, and on the following day there are numerous spots, with nocturnal fever; the fever continued next day, and was at 101° the day after,

when the earlier and more considerable spots were drying; fresh small spots continued to appear on the two following days with diminishing febrile action; six days were febrile. A brother, aged 3 years, whose case is represented in the diagram, remaining in the house and occupying the same room had the first symptoms of the illness fourteen days from its commencement with his sister, and ten from the day of greatest fever, when she remained in bed. Two other children in the family sickened on the following day.

A woman who had been assisting in a room where there was chicken-pox, spends an afternoon in the end of November with her sister, living at the distance of half a mile, who has two children at home; the younger (Case 2), a girl aged two years and eight months, was restless in the night of December 14th, she had some red spots on December 15th, and was seen by me December 16th with well-marked chicken-pox. The pulse was 180. Respiration 40 to 60 in the minute. Temperature in the axilla 101°; next day, pulse 120, respiration 30, temperature 100°, with but few new spots. On the 18th the spots were drying and there was no increase of temperature at night. On the 19th the pulse was 100, the respiration 30, the temperature 98° only.

Case 3.—A boy, aged six years and ten months, with his sister throughout, was restless in the evening of December 27th, when one spot was detected on the head; he vomited in the night. On the 28th several spots appeared; pulse 120; respiration 24; temperature 101·3°. Next day pulse 100, respiration 26, temperature 99·7°; he was able to eat a chop at dinner; there were a few new spots; one or two of these on the chest and upper arm were rounded, flat, pellucid, with drying, if not depressed centres, and some areola; all the others were very characteristic of varicella. Here, at apparently the height of the disease, there was a fall of more than a degree and a half of temperature, though the boy had been kept warm in bed. On December 30th two new spots, full, opaque, of rounded outline, with red edges, appeared on the nates. Temperature 99·2°. December

31st, pulse 110; respiration 30; temperature 99·5°; one new spot, the last two are turbid; next day pulse 100, respiration 30, temperature 98·5°, and the disease was over. The temperature in this case closely corresponds with the diagram given for the first of these cases.

Case 4.—A younger brother, 5 years old, out to nurse under unfavorable hygienic conditions, was sent home on January 12th on account of another child in the same room with him being ill with chicken-pox. He showed the first symptoms of lassitude on January 21st, and a few spots were seen near the mouth that evening; the next day, and the day after very numerous vesicles were developed; he had a full and characteristic eruption, but seemed so little ill that he was not kept in bed; partly owing to this, and still more to the low state of health to which he had been reduced before the illness, he suffered afterwards with most intractable sores, which were not all healed on March 2nd, when he had again to leave home, nearly six weeks after the illness.

Rubeola.—Rosalia, or epidemic roseola, is nearly allied to measles, not only by a superficial resemblance, but also by having a long incubative period, and by culminating in a speedy subsidence of temperature on the appearance of the rash. The period of incubation, as elsewhere stated,[1] is from eight to ten days; the stage of invasion is short, and, so far as it has been possible to trace the temperature-variations during the pre-eruptive period, affords another illustration of how small is the disturbance created in the system by this class of zymotic poisons, of which vaccinia is the type, until the time has arrived for their ultimate development and expulsion. This is very striking in the form of exanthem to which the name of rubeola (as distinct from morbilli or true measles) ought to be restricted. Not only has no temperature disturbance been obvious until the night preceding, or the morning of, the rash, but there has been exceeding rapidity of both the rise and fall of temperature when this has been much disturbed. Once it reached 102° on the first day, was 101° on the second day, and below the normal on the third, with the rash still out. Where the disturbance has been less marked, a slight elevation of temperature has been noticed a day before the rash, has reached 100° on the day of the rash, was 99·6° on the second day, and 98·7° on the third, with traces of rash still on the face.

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[1] 'British Medical Journal,' 1870, vol. i, pp. 99, 100.

The great distinction between rubeola or rosalia and measles is the absence of the catarrhal stage of invasion; the appearance of the rash is generally closely similar. In a variety of this exanthem, having the same incubative period, the rash, instead of appearing like measles, presents a finally diffused redness which, except that on the face it has a more rosy hue, could not be discriminated by the most experienced and careful observer from the rash of scarlet fever, though differing from it absolutely as measured by temperature. The temperature change accompanying this form of rubeola is even slighter than in the other; it precedes the rash by a few hours, and has often quite subsided when the rash is most conspicuous, so that, at the time of the greatest redness, the temperature has by evening become normal, or been found at, or even below the normal.

Another class of acute specific diseases characterised by the shortness of the incubative period and the irregularity of the subsequent temperature changes, comprises diphtheria, croup, scarlatina, relapsing fever, cholera, summer diarrhœa, influenza, and whooping-cough. Temperature-changes for the two first of these diseases have been already given;[1] the high temperature marking the course of choleraic or summer diarrhœa in infants is described in a previous paper.[2]

Scarlatina.—Scarlatina, or scarlet fever, may be taken as the type of this class. As illustrating the shortness of the incubation period, instances of twenty-four hours (Trousseau) and of less than twenty-four hours (Murchison) have been ascertained; the duration of this period may extend to five days; the period of invasion is from three to thirty hours only. In scarlet fever, though the highest temperature often corresponds with the height of the rash, there is no necessary fall of temperature with the fading of the rash; and though at the height of the rash the temperature is high, and is often at its height at the end of the first week of the disease, yet with no other complication than stomatitis or coryza, it has continued at 101° and 102° up to the end of the third week.

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[1] Reynolds's 'System of Medicine,' 2nd edition, 1870, vol. i, pp. 118—120, 139; also pp. 79, 80, 84.

[2] 'Infantile Temperatures,' p. 17. 'Obs. Trans.,' vol. x, pp. 285, 6.

Tables of the lowest ranges of temperature met with in undoubted cases of scarlet fever are here given for comparison with temperature variations in allied diseases: the normal range of temperature in the third case, not a mild one, is evidently controlled by the use of quinine.

TABLE 6.—*Scarlatina mitior.*

CASE 1.—Girl, æt. 2 years and 10 months.

Day of illness.	Date.	Temperature. Morning.	Temperature. Evening.	Remarks.
1	March 2	...	...	Fretful, ill at night.
2	„ 3	102·0°	...	Full rash.
3	„ 4	102·0°	...	Tonsils full.
4	„ 5	100·8°	...	
5	„ 6	...	100·0° 3 p.m.	
6	„ 7	99·2°	99·0° only, at night.	
7	„ 8	Normal.		

CASE 2.—Boy, æt. 8 years.

Day of illness.	Date.	Pulse.	Resp.	Temperature. Morning.	Temperature. Evening.	Remarks.
1	Dec. 8	140	30	...	102·2°	Rash on neck and chest, arch of palate red.
2	„ 9	...	...	101·2°		
3	„ 10	...	...	100·6°		
4	„ 11	...	...	100·0°		
5	„ 12	...	...	99·6°	100·0°	
6	„ 13	...	...	...	100·0°	Epistaxis.
7	„ 14	...	...	99·6°		
8	„ 15	...	...	98·4°		
9	„ 16	...	...	...	101·0°	Constipation.
10	„ 17	...	...	99·0°		
11	„ 18	...	...	98·4°	...	Some secretion from right ear, slight deafness.

Scarlatina.

CASE 3.—A boy, æt. 4 years. Temperature-changes arrested by quinine.

Day of illness.	Temperature in axilla. Morning.	Evening.	Remarks.
1	...	...	Vomited at night.
2	...	102·0°	Rash on face and chest, palate red.
3	103·0°	...	Half a grain of quinine three times a day.
4	100·8°	100·4°	
5	98·6°		Stop quinine; an aperient given.
6	99·4°	100·1°	Resume quinine.
7	98·6°	99·8°	Tonsils full.
8	99·4°	...	To take iron with smaller doses of quinine.
9	...	99·0°	Castor oil given.
10	...	98·4°	Takes food well.
12			Defective vision, ciliary muscles paralysed (?), tonsils full.
15			Improving; thick, glairy mucus at back of pharynx.
32			Desquamation complete; some paralysis of abdominal muscles.
38			No action of bowels since last report; convalescent.

The following case (4), and the next but one (Case 6), show the influence of quinine and the inutility of alcohol in checking the tendency to high temperature during the course of scarlet fever.

CASE 4.—A boy, æt. 2½ years. Suffered from congestion of left lung six months before.

Day of illness.	Pulse.	Resp.	Temperature in axilla. Morning.	Evening.	Remarks.
1	...	...	...	...	Restless; rash; seemed well the day before.
2	130	35	99·4°	...	100·4° *in recto*; throat red, rash fullest over the back.
3	...	...	99·6°	...	Rash extends to legs, uvula red; sleeps well at night.
4	130	...	100·2°	...	Rash most on thighs; glairy mucus from one nostril.

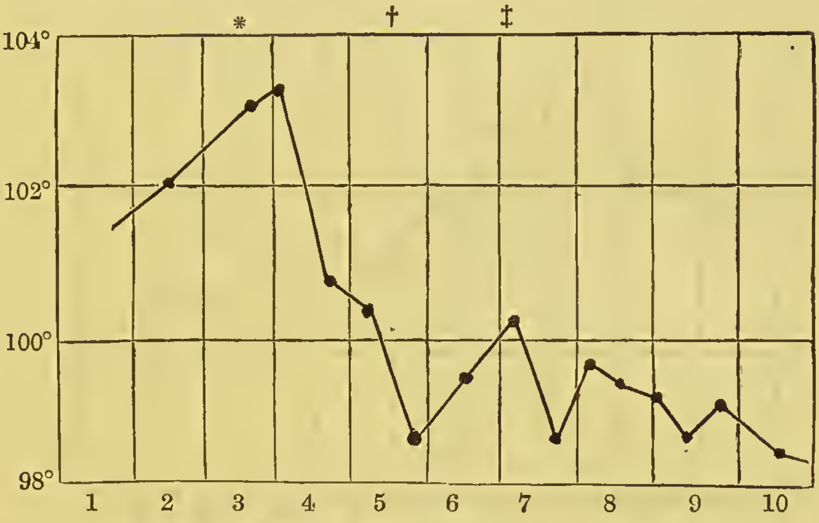
Day of illness.	Pulse.	Resp.	Temperature in axilla.		Remarks.
			Morning.	Evening.	
5	130	30	101·0°	...	One tonsil full; eats and sleeps well; excreta natural.
6	120	30	100·2°	...	Throat better, no coryza.
7	130	30	102·2°	...	Is restless; looks pale.
8	130	40	101·6°	...	Congestion at base of left lung; to be poulticed.
9	120	40	100·4°	...	Respiration audible at base; restless at night; wine given.
10	120	50	101·4°	102·0°	Enlarged cervical gland; to take quinine 1 gr. in powder.
11	120	40	98·4°	99·1°	*in recto* at 4 p. m. Slight alcoholic stimulant.
12	120	40	99·2°	101·3°	Fulness of neck on both sides; 1 gr. quinine repeated at night.
13	120	36	98·0°	...	98·5° *recto;* a little wine and water allowed.
14	100	30	98·0°	...	Less swelling of cervical glands.
15	...	...	...	...	To take steel wine and cod liver oil.
20	100	30	97·9°	...	Seems well; swelling of neck almost gone, cervical glands still perceptible, signs of fine desquamation on hands and feet, skin otherwise clear; has not left the room.
41	120	30	...	...	Submaxillary gland still perceptibly enlarged; the bowels generally acted freely, often disturbed; urine deposited lithates, never albuminous.

This child had been kept indoors three weeks longer than necessary for his own health.

Had the pyrexia on the tenth and twelfth days not been arrested, the swelling of the cervical glands would probably have then become a serious complication; the good effect of quinine, as contrasted with that of alcoholic stimulants, was at that time very obvious.

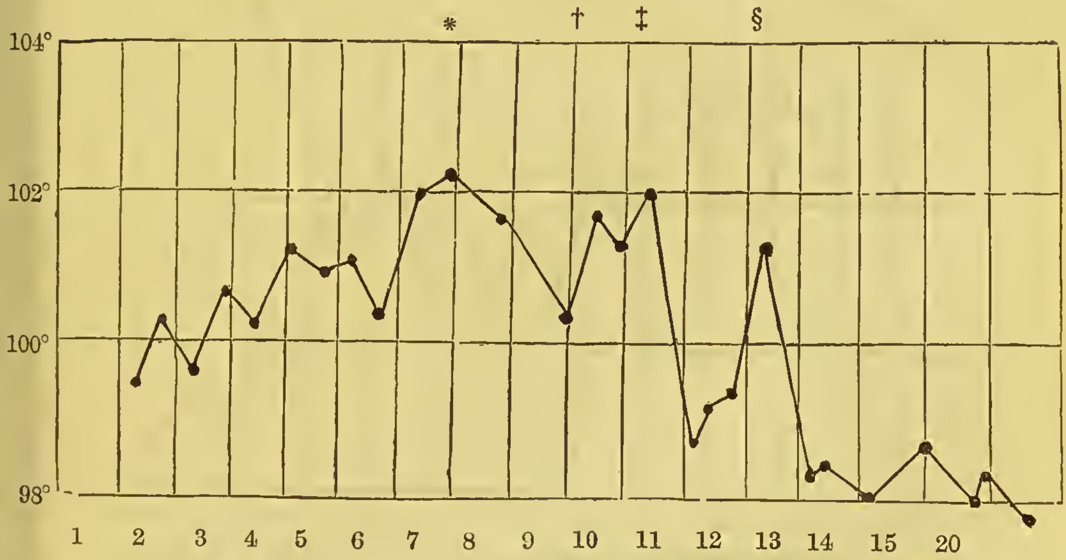
Diagrams of Scarlatina.

Case 3.—A boy æt. 4 years.



* Quinine given, 3 grains. † Stop quinine. ‡ Resume quinine.

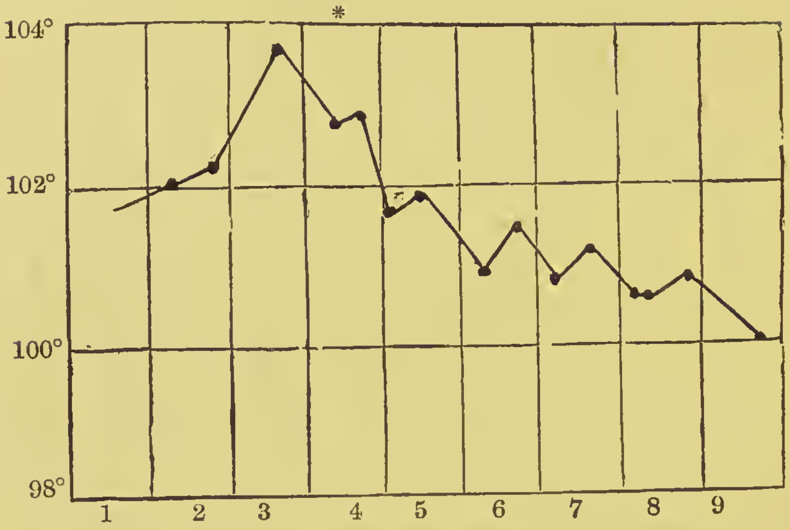
Case 4.—A boy æt. 2½ years.



* Congestion of lung.
† Port wine given.
‡ Quinine given, one grain in powder, and repeated twice.
§ Resume quinine one grain at night.

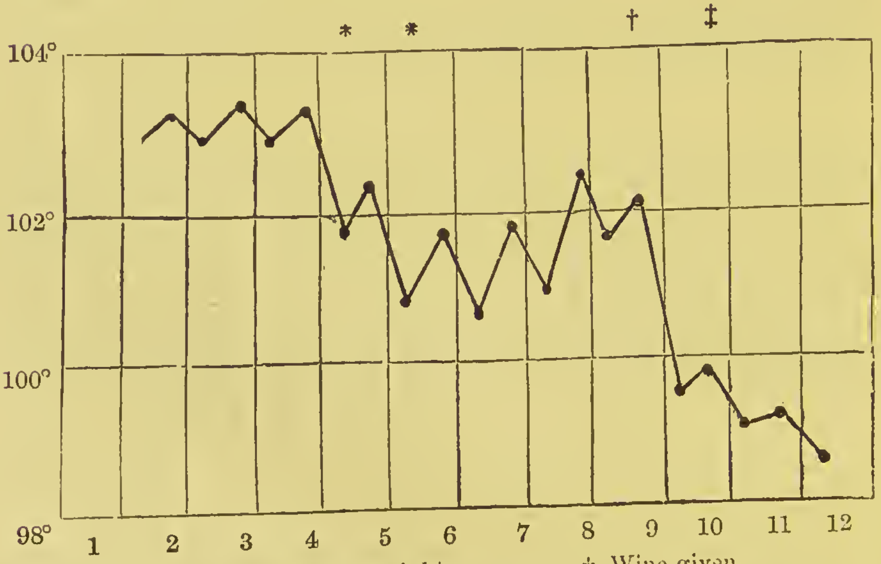
Diagrams of scarlatina.

CASE 5.—A girl æt. 3 years.



* Quinine given.

CASE 6.—A girl æt. 7 years.



* A dose of quinine at night. † Wine given.
‡ Quinine given regularly.

TABLE 6.—*Scarlatina.*

CASE 5.—A girl, æt. 3 years. Has been hoarse, and complained of throat for four days. Two sisters in the same room are recovering from scarlatina.

Day of illness.	Pulse.	Resp.	Temperature in axilla. Morning.	Temperature in axilla. Evening.	Remarks.
1	...	...	...	...	Vomited in the morning; fever at night.
2	140	34	102·2°	...	Full rash, palate red, temp. 101° only in the mouth.
3	180	40	...	103·6°	Sickness and diarrhœa.
4	170	40	...	102·8°	Tonsils full, throat sore; iron and quinine given.
5	160	34	101·7°		Throat better.
6	120	34	...	101·2°	Skin very red, harsh; enlarged cervical glands.
7	120	30	...	101·0°	Skin red, soft, less swelling over gland.
8	120	30	...	100·8°	Better; lips cracked and sore.

Continued to improve.

CASE 6.—A girl, æt. 7 years. Complains of throat for a day or two, then vomited. Source of infection unknown.

Day of illness.	Pulse.	Resp.	Temperature. Morning.	Temperature. Evening.	Remarks.
2	120	40	...	103·0°	in the mouth, probably more on surface; slight rash.
3	120	30	102·8	103·1°	102·9° at night, after a third action of the bowels.
4	110	30	102·8°	103·2°	To take acid medicine in place of saline.
5	110	30	101·8°	102·2°	A grain of quinine given at night.
6	108	26	100·8°	101·7°	Repeat quinine.
7	108	28	100·5°	101·8°	Bowels confined; no medicine.
8	108	30	101·0°	102·4°	Claret given; no action of bowels.
9	100	30	101·6°	102·1°	Bowels relieved; to take one grain of quinine, and repeat it in the morning.
10	100	25	99·4°	99·6°	Some fulness of tonsils; to take iron and quinine.
11	100	24	99·2°	99·4°	Constipation; relieved by castor oil.
22					Very free desquamation; a tendency to constipation; no albuminuria at any time.

The effect of quinine in controlling the high temperature of scarlet fever is still more marked in a case of great severity which concludes this series. The brother of the little girl whose case is last given, having been some months in the country, detained there the last two in consequence of his sister's attack of scarlet fever at the end of August, returns on October 9th and is put to sleep in the room in which his sister was ill, the room and the bedding had undergone a thorough purification, but the curtains which had surrounded the little girl one night only at the commencement of her illness and had been put away since August 30th, after only a few days' exposure to the air, were now hanging in alarming proximity to the face of the present patient. Four younger children, and a girl fifteen years old, in the nursery, never having had scarlet fever, remained in the house throughout, without showing any symptoms of illness; moreover, the convalescent sister had returned to them seven weeks from the commencement of her attack, yet no one but this boy takes the illness.

The ingress of the pyrexia was as sudden as it could possibly be; the child was observed at 2 o'clock in the afternoon to be seemingly in the most robust health, and by six in the evening he was obviously ill with a severe attack of scarlet fever. Whether this is from his sister or from the curtains under which he slept (though in neither case need the germ have been imparted long before) the cause of infection must be considered as acting continuously, and the effect is not produced until ten days from first exposure.

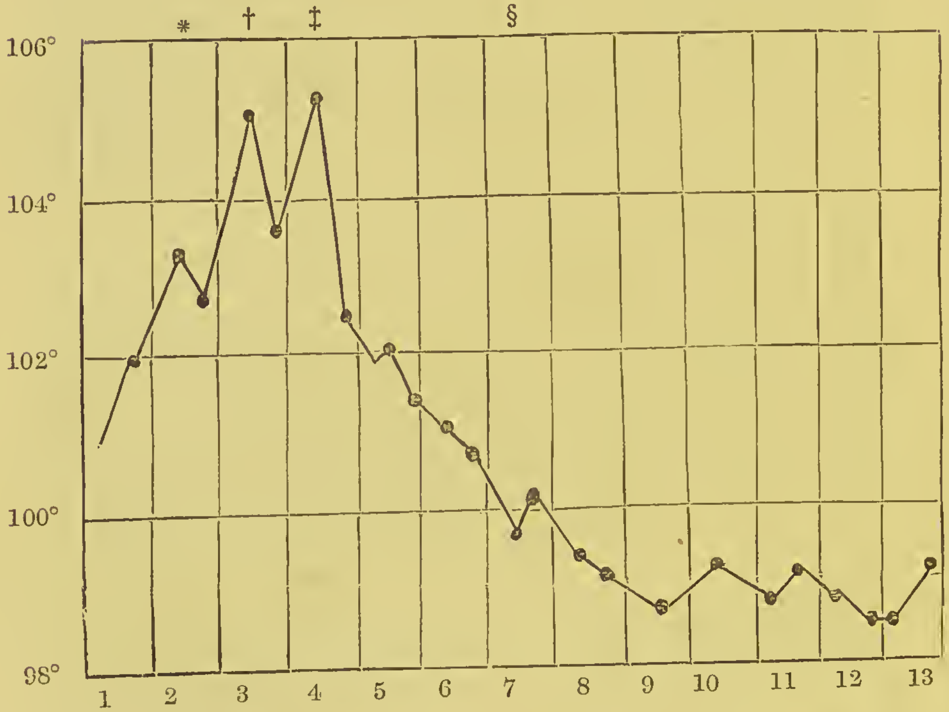
Case 7.—A boy, æt. 8¾ years, suddenly seized on October 19th, in the evening, with headache, sore throat, and vomiting; has the rash of scarlet fever by night, with high fever and delirium.

Day of illness.	Date.	Pulse.	Resp.	Temperature in axilla. Morning.	Evening.	Remarks.
	Oct. 19	...	...	...	...	...
2	,, 20	130	46	103·2°	102·5°	Full, dusky rash, bad throat; muscular twitchings at night, and great prostration.

Day of illness.	Date.	Pulse.	Resp.	Temperature in axilla.		Remarks.
				Night.	Morning.	
3	Oct. 21	140	48	105·0°	103·5°	One grain of quinine given at noon, not repeated at night; delirium.
4	„ 22	128	40	105·0°	102·2°	Three grains of quinine in the afternoon and two at night, with ice to the head.
5	„ 23	100	30	102·0°	101·2°	Slept well, quite cheerful and intelligent to-day; rash less intense, throat freer from sordes, redness of left tonsil, glands tender.
6	„ 24	100	28	101·0°	100·7°	Urine passed twice to-day for the first time; swelling under left ear, ulcer of left tonsil, red swelling of soft palate, exudation on uvula.
7	„ 25	92	26	99·7°	100·1°	Petechiæ on neck and chest, restlessness last night extreme; to commence wine and take steel with the quinine.
8	„ 26	80	28	99·4°	99·0°	Slept well, throat clearing, ulcer healed, much less swelling of glands.
9	„ 27	80	24	98·7°		Takes solid food and wine; stop quinine.
10	„ 28	88	26	99·1°		To resume one grain of quinine twice a day with steel.
11	„ 29	80	24	98·8°	99·1°	Urine free, with excess of phosphates, no albumen.
12	„ 30	76	22	98·8°	98·6°	Fine desquamation on chest.
13	„ 31	72	22	98·6°	99·1°	Tendency to constipation; discontinue steel.
15	Nov. 2	88	26	99·5°		Uric acid; to take less wine.
21	„ 8	84	24	...	99·1°	Desquamation everywhere.
25	„ 12	84	...	98·7°	...	Slight fulness of cervical gland remains.
34	„ 21	84	26	99·1°		Some fulness of tonsils; to go out.

Here the intensity of the disease necessitated a large quantity of quinine, which did not cause either deafness or other inconvenience. Quinine seems to control any tendency to vascular or other excitement that might be occasioned by the free use of wine; this is traceable both on the seventh and tenth days: the most marked benefit from it is seen at the very height of the fever, when, the general pyrexia being under its control, the heat of head and restlessness at night were readily subdued by the application of ice, and good sleep followed. Next day the intelligence, cheerfulness, and perfect memory displayed make it impossible to suppose that any cerebral congestion had resulted from the remedy, or any cerebral injury from the pyrexia.

Diagram of scarlet fever influenced by quinine.



* Muscular twitchings, great prostration. † One grain of quinine only given.
‡ Three grains of quinine given and repeated.
§ Wine commenced and given freely next day.

The effect of quinine in scarlet fever is seen in this diagram of the case under consideration. Six grains of quinine in one day and three grains on subsequent days sufficed here; from fifteen to forty grains are often requisite in older persons; the latter quantity has been given in one night with most marked benefit to a boy of sixteen, where fever from another cause was running high. Scarlet fever in the puerperal state requires the largest doses in combination with the stronger forms of iron. Albuminuria has rarely followed in the cases of scarlet fever that have been selected for careful observation, nor as yet, it is worthy of remark, has acute albuminuria been observed in those treated by quinine. After complete devervescence, albumen has appeared with desquamation of the renal epithelium, in one case partially treated in this way.

In reducing the high temperature on which the chief danger not only to life, but to the integrity of the tissues in these diseases depends, quinine is as powerful a remedy as cold affusion, and is much more convenient and serviceable; it is nearly as efficacious in typhoid fever, when, the pyrexial period being more prolonged, the cerebral disturbance is greater: how much of this might have been prevented by its use in cases that come to mind! Once in a child convalescent from typhoid fever loss of memory was so complete that whole weeks remained a blank. Cinchonine has a similar influence, as is illustrated in a case of typhoid fever given at the end of this paper.

The communication of scarlet fever from one person to another in the same household, even where there are several children, is generally preventible. To effect this the general requirements are a separate room for the sick, bared as much as possible of furniture; a sheet or linen curtain, on which disinfectants can be sprinkled, suspended over the door, and the removal of any carpet or rug from the outside of the door of the sick room; strict cleanliness within the room; the immersion in water containing a disinfectant of whatever has to be removed from the room; an intelligent attendant, and a sufficiently prolonged isolation of the patient. Olive oil containing one twentieth part of carbolic acid, applied to the skin, is useful; in the earlier part of the illness it is grateful to the patient, in the latter part it obviates some of the dangers attending desquamation. Several instances, where families of six or seven children all remaining in the house have escaped while one of the number was going through an attack, have come under notice. Even where a family of three children had but a single sleeping room, and where part of it only could be set apart for the treatment of a child seized with scarlet fever, the intelligent application of these principles secured the immunity of the others. So true is it that disinfection, to be real, must begin at the bodies of the sick.

The great difficulty in checking the diffusion of scarlet fever is the uncertainty as to when the infectious period of the disease is over. Six weeks must be taken as the least time allowable for the persistence of personal infection. The way in which clothes may retain infectious particles is easily understood, and may be readily guarded against. The disinfecting of the house is a more difficult problem; chief dependence must always be placed upon the care taken to meet every cause of infection at its source. Afterwards, liberating fumes of sulphurous acid, by sprinkling sulphur on some live coals properly placed, is of use; a thorough cleansing of the room is necessary, also the free admission of air; even then, time must aid to free the roof from all taint.

To arrest the spread of scarlet fever at the outset, presents a less difficult problem than to limit its extension afterwards. The marked character of the earliest symptoms, the suddenness of the invasion, and the shortness of the incubative period, all tend to favour the success of an immediate segregation of the sick. It is to be remarked how often those escape who are removed from contact with the sick during the first two days of the disease, and how sometimes a short contact with a convalescent has been rapidly followed by symptoms of the illness. The quarantine necessary to those who have been exposed to infection that may guard against their becoming agents in disseminating scarlet fever is not very protracted; evidence of the shortness of the incubation period is conclusive; this, indeed, can hardly be admitted to extend, even at its longest, to five days, so that generally a week will show whether any one so exposed has taken the disease or not. A difference of result may be looked for where there is continuous exposure to the source of infection to where there is complete removal from it; under the first circumstance four or five days of slight sore throat or precedent hoarseness have been occasionally met with. Where there has been prompt removal from the infecting cause eight days has been the longest interval from exposure to sickening, under my own observation, isolation being as complete as possible; where the removal has been less prompt, unless a complete immunity from infection may be anticipated, the probabilities are that the disease will declare itself in even a shorter time. A period of hours only has in some instances sufficed for the development of the disease, so that when so long a time as five days is given for incubation,[1] we must conclude either that there has been some hindrance to the passage of germs from the lungs to the blood, or that the first portions absorbed must have been thrown off harmless; at the same time, when a period so long as even twelve days has been given by some writers as a possible one in which the disease might appear, this interval would not be too long for observing a quarantine that might check the spread of so dread a pest.

Influenza, though rarely exanthematous, and liable to recurrence, has alliances with scarlet fever, chiefly in the rapid development of its early stages, and somewhat in its after course, whether that take the form of the herpetic catarrh of spring, the diarrhœa of summer, or the bronchitis of winter.

Hooping-cough, which, but for a doubtful turgescence of skin and the petechial spots sometimes met with, would not be exanthematous at all, has some affinities with this class of disease. It is with difficulty distinguished at the outset from influenza; both, at first, alike depress most seriously the weakest and youngest, yet the more marked consequences of the one and its much longer course render an early recognition desirable. Some essential differences should not be wanting to the early stages of a disease differing so widely in its after course as hooping-cough does from influenza, in that it is almost always exempt from recurrence.

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[1] The evidence as to the infection of Relapsing fever is the other way. Exactly five days elapsed from complete removal from the sources of infection to the appearance of the disease in an unexceptionable instance; a doubt as to other sources of infection must attach to the cases from Camberwell workhouse, where the passing one night in infected wards was followed by the appearance of symptoms of Relapsing fever in the morning.

This difference is found in the pyrexial period of the early stage of the disease, being sometimes more intense, and always more prolonged in hooping-cough than in influenza, and in the incubative period of hooping-cough being much longer. Again, there is this point common to them, which occurs also in other diseases, that on the establishment of the local process the general temperature shows a tendency to decline.

Influenza seems to be immediately infectious, and twice it has occurred to me to meet with the first symptoms before elevation of temperature had set in. In one instance there was altered voice and a visibly red epiglottis; in the other, to be presently tabulated, sneezing and slight diarrhœa. In the slighter cases the pyrexial period may be a few hours only, secretion is readily established, and the temperature rapidly declines.

To take, in the first place, simple cases of influenza catarrh. An infant, a boy of three years, and a girl of one and a quarter, come from the country on April 10th to a house where the servants in charge had influenza colds. The little girl has diarrhœa on April 14th; on the 15th there is slight coryza and the first elevation of temperature; on the 16th some harshness of respiration, with a temperature of 100° axillâ; 17th, temperature normal, much defluction from nose; 18th, temperature 97·6° axillâ, and only 98·6° recto. The little boy was well on April 16th; on the 17th was hot and restless, had spots of herpes on the arm in the evening, and coughed in the night; 18th, temperature 99° axillâ, perspiring after a midday sleep; 19th, cold in the head, temperature normal. The infant, who was more restricted to the nursery, while the elder children went into other parts of the house, coughed at night on April 20th; on the 21st had signs of catarrh but was not kept to the house, the weather being hot and the catarrhal symptoms trivial.

In cold weather more serious disturbance is to be apprehended. On January 21st a boy, two and a half years old, is feverish at night and has croupy cough. 22nd, harsh cough; slight difficulty of swallowing; glandulæ concatenatæ palpable; pulse 160; respiration 40; temperature 101°. 23rd, loose rhonchi in larger bronchi; pulse 160; respiration 40; temperature 99·6°. Next day, pulse 100; respiration 30; temperature normal; some loose cough.

In the nursery with this child is an infant-brother three and a half months old, who, not having been out, was noticed to sneeze on January 23rd. Observations made at the very commencement are given in the following table.

TABLE 7.—*Influenza.—Pneumonia.*

CASE 1.—

Day of illness.	Date.	Pulse.	Resp.	Temperature in recto. Morning.	Evening.	Remarks.
1	Jan. 23	120	40	...	98·8°	Below the normal for this child.
2	„ 24	135	50	...	101·4°	Cough, harsh respiration, bowels relaxed.
3	„ 25	130	60	101·7°	...	Kept awake by incessant cough, high-pitched rhonchi at scapulæ.
4	„ 26	160	70	102·6°	...	Dulness at left base and diminished expansion.
5	„ 27	180	...	102·4°	103·0°	Crepitation.
6	„ 28	160	60	101·0°	102·3°	Secretion commencing.
7	„ 29	140	60	100·5°	101·0°	Large loose râles, dulness at left base.
14	Feb. 5	...	...	99·2°	...	Expansion good, lungs healthy, some consonant râles heard in large bronchi.

The next table also indicates pulmonary complication. A girl, aged four years and two months, sleeps in the same room with an elder sister, who came home from school with bronchial catarrh on December 11th, 1868. It was noticed at night how quick was the breathing of the one girl and how quiet that of the other. The next morning, at 5·30 a.m., a change was remarked in the younger girl; by 7 a.m. there was rapid breathing, afterwards coryza and some fever, though she was cheerful in the afternoon. Throughout the next day, December 13th, she was said to have a severe cold.

TABLE 7.—*Pneumonia.*

CASE 2.—

Day of illness.	Date.	Pulse.	Resp.	Temperature. Morning.	Temperature. Evening.	Remarks.
1	Dec. 14	140	60	101·0°	...	Congestion of left base.
2	„ 15	160	60	100·5°	...	Pallid, alæ nasi work.
„	„ „	140	70	...	100·6°	Crepitation at base.
3	„ 16	140	70	103·0°	100·1°	Rusty sputa.
4	„ 17	140	60	100·5°	...	Better.
5	„ 18	140	50	98·4°	...	Loose râles everywhere, aphthæ in mouth. Ultimate recovery perfect.

The eldest sister had a temperature of 101° in the evening of December 11th; next day, though she had some congestion of left lung, with mucous rhonchus and great acceleration both of pulse and respiration, the temperature was lower; and on the fourth day, with abundant sonorous râles, the pulse was 120, respiration 40, temperature normal. Two other children of this family on December 13th and 14th were similarly attacked.

In another nursery of four children an elder sister comes home from a day school with cough on December 8th; on December 10th the younger sister, two years old, has a similar cough; on December 13th a stout florid boy of three and a half years, who has once had croup, becomes suddenly febrile, and at night has a temperature of 101°; his breathing is rapid, both inspiration and expiration prolonged; diffused râles; cough.

Day of illness.	Date.	Pulse.	Resp.	Temperature.	Remarks.
2	Dec. 14	140	50	101·5°	
3	„ 15	120	40	99·5°	Râles, most at left base.
4	„ 16	110	40	98·0°	Loose sonorous râles everywhere.
5	„ 17	160	40	100·8°	Excitable; râles almost gone.
6	„ 18	120	35	98·0°	Râles have returned.
7	„ 19	Nearly well.			Respiration slightly harsh.

Here were two nurseries of young children all ill together with this contagious catarrh, and in both these nurseries the nurses became affected with herpetic sore throat, coming on with intense aching of back and limbs, and resulting in the formation of several small ulcers on the tonsils in one case, and a larger, round, yellow ulcer of one tonsil in the other. In either case there was a temperature of 102° on the second day, with complete defervescence on the third, though the throat, edge of palate, and back of pharynx continued to be red.

The herpetic variety of this form of catarrh is not unfrequent, and may be considered as the sporadic form of influenza; it comes on after one day of chilliness or pain, has one or at most two days of pyrexia, which subsides often most completely on the third day, requiring, however, but slight variations in the circumstances of its occurrence to be prolonged with various complications. In children it is frequently followed by ecthyma, and so great is the tendency of infectious diseases, not only to propagate their kind, but even their individual peculiarities, that several children of a family will often be seen with ecthymatous pustules, the result of influenza colds, on their faces or fingers, and appearing so nearly together as to give rise to the idea of the exudation itself having contagious properties, while, in reality, they have resulted only from a common infection acting on a common predisposition. There are other complications however of far more importance, and excluding the modifications of this influence mentioned at the commencement of the section, certain distinct and separable forms of it capable themselves of acquiring epidemic influence; yet neuralgia, rheumatism, quinsy, gastric catarrh, diarrhœa, dysentery, bronchitis, and pneumonia frequently result so directly, and the number of unplaced phenomena bearing upon the subject is so great, as to make one conclude that there is no such thing as idiopathic inflammation at all, and that the history of "common cold" has yet to be written.

In the following instances of high temperature associated with influenza the influence of a diathesis is obvious.

CASE 1.—A boy, æt. 5 years and 4 months, has suffered, together with three older and two younger children in the family, from influenza colds, with herpetic and impetiginous spots chiefly on the face; this child has ecthyma of one finger extending to the nail, the remains of some eruption at the right angle of the mouth, and a sore at the edge of the right nostril, obstructing it. He has suffered much from illness; he had croup as an infant, subsequently some meningeal affection, and is slightly hydrocephalic; most of the teeth are decayed, but he is lively and well grown; frequently stumbles in his walk. During the past week's illness he has passed water involuntarily at night, and has been nervous and frightened in the day; he has complained of pain in the head, and has frequently squinted. February 21st, was sick in the night, and had no relief from the bowels. At 2 p.m. the pulse was 140; respiration 44 in the minute; temperature in the axilla 103°; pain complained of behind both ears; no otitis; glands of the neck are perceptibly enlarged. At 4 p.m. he was relieved by black vomit, and afterwards by similar matter from the bowels; a small dose of calomel was given; he afterwards slept well. Next day, February 22nd, the temperature in the axilla was 100°, and the day after 99°; there were streaks of mucus at the back of the pharynx; the head symptoms, pronounced at first to be secondary, had entirely disappeared. The bowels showed a tendency to constipation till the 26th, when there was restlessness at night and involuntary micturition. On the 27th the action of the bowels was normal, but the urine contained uric acid, which largely deposited on the 28th. March 2nd.—Pulse 100; respiration 26; temperature, axilla, 98·8°. Nostril healed; angle of mouth sore; back of pharynx red, streaks of mucus on it; appetite better; a dessert-spoonful of wine at dinner makes him excitable and prevents his walking steadily; to discontinue wine, and take syrup of iodide of iron. The nurse had ulcerated sore throat on February 22nd, and herpes of lip on 24th.

In the next case a servant has herpes of the lip, and the illness of the child follows.

Case 2.—A boy, æt. 7, subject to sudden febrile attacks accompanying acute enlargement of tonsils; has had a pustular spot on one cheek for a few days. A servant in the house had herpetic catarrh a week before.

Day of illness.	Date.	Pulse.	Resp.	Temp.	Remarks.
	Mar. 22				Woke early in the night with a croupy cry, hot and restless afterwards.
1	,, 23				Both tonsils large, smooth, left slightly red, glands on left side of neck palpable, temp. axilla 103·0°; tincture of steel given.
2	,, 24	120	30	101·0°	Throat red, no specks on tonsils, viscid defluxion from nostrils.
3	,, 25	112	28	99·4°	Tongue clean, tonsils paler, still full; a small pustule on neck.
4	,, 26	100	20	98·8°	Acrid discharge from nose; sleeps well.

The following case is as much like quinsy as possible in a child so young.

Case 3.—A girl, æt. 4½, complained of fatigue and loss of appetite on April 26th. Wine given at night; great fever and restlessness afterwards.

Day of illness.	Date.	Pulse.	Resp.	Temp.	Remarks.
1	April 27	...	...	Burning heat.	Vomited; an aperient caused one very dark evacuation.
2	,, 28	144	48	103·0°	Face and arms red, tonsils full with white specks.
3	,, 29	120	30	102·2°	Tonsils enormously distended, glands of neck hardly perceptible.
4	,, 30	110	25	99·1°	Appetite returning; fulness of tonsils has subsided, but they meet, the specks have red edges; uric acid in urine.
5	May 1				Improving; rapid subsidence of tonsils.

As an illustration of bronchial catarrh in which the temperature falls, as secretion is established, may be mentioned the case of a boy, æt. 5, attending a day school, who has slight signs of cold on May 19th, with relaxation of the bowels. On the 20th he is flushed and excitable in the evening, very hot in the night, and disturbed with noisy breathing; pulse 140; respiration 32; temperature 102·8 in the axilla. Next day the respiratory sounds are weak, the fever rather less; salines and rest in bed are prescribed. On the 22nd there are increased signs of bronchial irritation and less fever. On the 24th free bronchial secretion; temperature 97·4 in the axilla.

Case 4.—*Gastric catarrh; sudden fall of three degrees in temperature after purgation.*—A boy, æt. 3, of rapid growth, thirty-eight and a half inches high (he was thirty-six inches in June last, and thirty-seven and a half in October, so has not grown so rapidly of late) has a slight cold on February 19th; next day, weather being very cold, he is out long and late, and complains of pain in stomach and limbs.

Day of illness.	Date.	Pulse.	Resp.	Temperature.		Remarks.
				Morning.	Evening.	
1	Feb. 20	...	...	...	...	Cough at night and diarrhœa.
2	,, 21	130	30	...	102·0°	Headache, rigors, talks in sleep.
3	,, 22	120	30	101·0°	101·4°	Pain in stomach, no cough.
4	,, 23	140	40	102·5°		Tongue furred, yawns, mouth twitches; calomel $\frac{2}{3}$ grain given.
5	,, 24	110	30	99·4°		Bowels three times acted on last night.
7	,, 26	100	26	Non-febrile.		One natural action of bowels.
14	March 5	A sister has cold and sore throat; so has a servant, who also has herpetic spots.				

The weather became suddenly mild on February 20th, with a half-inch fall of the barometer, when the following case of bronchial catarrh was observed.

Case 5.—A boy, æt. 2, still at the breast, the canine teeth not cut, has heat of head on the 21st, cough on the 22nd, coryza on the 23rd, first seen by me on the 24th.

Day of illness.	Date.	Pulse.	Resp.	Temperature.	Remarks.
4	Feb. 24	120	40	100·0° recto.	Sonorous rhonchi at back of chest, sordes on gums, had been purged by calomel.
5	„ 25	120	46	100·6° „	Gums lanced, great irritability, no coryza.
6	„ 26	120	40	100·4° „	Loose cough.
8	„ 28	120	30	100·0° „	Bronchial râles, coryza.
9	March 1	130	40	101·2° „	Harsh respiration with moist râles, excitable at night. Improvement followed upon an improved diet. Dentition was completed by the end of the year without difficulty.

Lancing the gums in this case had no influence on the temperature changes, and the calomel purge at the commencement was injurious. Next spring this child has a similar cold, followed by ecthyma as in the last of these cases, and again was calomel unadvisedly administered.

In the following case, occurring in hot weather, the febrile disturbance was neither made shorter nor less by the early use of calomel; moreover, although one of the last two molar teeth was not quite above the gum, and the other quite under it, they were not interfered with, and the temperature crisis, as in the first of these cases, was determined by a copious deposit of uric acid.

Case 6.—A girl, æt. 2½, well grown, and in apparent health, travels by railway to the seaside on August 14th, the weather being hot, with a cold wind. The bowels are twice disturbed on the evening of arrival. The next day she is out much in the wind, and becomes feverish at night, and is of a burning heat in the morning, when a dose of calomel is given; both vomiting and purging were induced, the fever at night was no less, and next day, August 17th, two doses of calomel were given, and a warm bath at night.

Day of illness.	Date.	Pulse.	Resp.	Temperature in axilla. Morning.	Temperature in axilla. Evening.	Remarks.
3	Aug. 17	...	...	...	103·0°	Frequent disturbance of bowels.
4	„ 18	140	40	102·3°	102·3°	Mucous purging, dry tongue, husky cough.
5	„ 19	130	40	02·0°	102·5°	Urine scanty, bowels free, skin moist.

Day of illness.	Date.	Pulse.	Resp.	Temperature. Morning. Evening.	Remarks.
6	Aug. 20	116	25	97·2°	Slept well, urine very free, with large deposit of uric-acid crystals.
8	„ 22	No return of fever, action of bowels slight and of light colour, almost white on the 24th, natural by the 26th.			

A round worm was voided by this child early in the November following.

Salivation from Steadman's teething powders.

A girl, æt. 2, has a cold, and is thought to be ill from teething, the last four molars not being through. The above powders, calomel and opium, are given frequently.

Date.	Temperature.	Remarks.
April 3	102°	Gums swelled nearly to the level of the teeth.
„ 4	101°	Mouth less sore, gums and cervical glands swelled.
„ 7	99°	Mouth well, health improving.

Last molars are not nearly so forward as might have been expected from the case of early dentition with this child; unfortunately the powders were commenced during some disturbance with the appearance of the canine teeth some months since; by frequent repetition they had caused the usual arrest of development until the elimination of the poison was at length attempted.

Continuous elevation of temperature accompanying an eruption on the face and body.

A boy, æt. 3½, strong and healthy, but subject to sudden febrile attacks. After a cold has an eruption extending from the upper lip to the right cheek, which is swollen. When the child was first seen, on April 8th, these spots had become pustular, but numerous raised spots, minutely vesicular (the spots on the cheek said to be like these at first), appear on the chest, abdomen, inner part of arms, outer part of thighs, and on the hips; the temperature of the mouth inside the right cheek is 100·3°. On April 11th it is 100·5°; pustules have appeared on the eyebrows, the spots on the hips are pustular, on one finger the cuticle is raised by a pustular secretion. April 13th.—Some spots are drying, others extending; temperature in the mouth 101·8°; in the axilla 101·5°; a new but less purulent bulla on finger, the first is well. The child does not appear to be ill; some of the places are irritable at night; those on the body extend in a somewhat circinate manner. April 16th.—All the places are better; purulent crusts are formed on the head; dry, raised crusts on some parts of the body; the face and lips clear; temperature in the mouth 99°, in the axilla 99·5°. April 25th.—Face quite clear; temperature in the mouth 97° only could be obtained; in the axilla still 99°·5. There are one or two recent spots on the shoulder, rounded, smaller, drying in the centre; on the dorsum of the foot is a circinate crop of similar spots. Child nearly well. Very little treatment beyond the bath was used; occasionally a mild aperient was required. The year before, on February 25th, the other children in the family having contagious colds, and this child having slight symptoms on the 23rd, he then has one of the short febrile attacks not unfrequent with him. He slept all day, ate nothing; temperature, axilla, at 5 p.m. 102·5°. He roused up before night, ate, and slept well; had no medicine, and next day, at 5 p.m., the temperature was 99·4°; small glands perceptible in neck. March 1st.—Pulse 112; respiration 28; temperature 99·4°; tone of voice indicative of cold. Some months previously the pulse was 100, the respiration 22 only, when in health.

Herpes zoster, or Shingles, belongs to this class of disease, and is liable to recurrence; it may directly follow upon a chill, or occur in the course of influenza. The pyrexia begins only with the first spots of eruption, and is greatest on the third day, when they are vesiculated. The general temperature subsides before the vesicles begin to dry, and then the local temperature, often previously at 101°, is not above the normal, though the skin be red and hot to the touch; so that, when at the worst, very little temperature-disturbance remains. The pulse is accelerated throughout, while the rate of the respiration is not affected.

Hooping-cough gives rise to a remarkable series of temperature-variations. The whole of what in my first paper is called the incubation period is pyrexial, often to a high degree, and is therefore always an important and sometimes a serious part of the disease. This generally occupies the first week of the illness, and as the characteristic hoop is then very uncertain in its appearance, a longer time often elapses before the presence of the disease is recognised. Hooping-cough, like scarlet fever, may be either immediately infectious, or may not appear till after an interval of more or less freedom from ailment, with this difference, that while in scarlet fever, if there be no appearance of rash by the eighth day after exposure to infection, there is a fair presumption of immunity, in hooping-cough seven days is probably the shortest limit of the period in which to expect the more obvious evidences of the disease to be developed.[1] During this period of invasion there is a marked and often progressive elevation of temperature, in itself sufficient to differentiate hooping-cough from the slighter forms of influenza, and sometimes, as in the two cases which follow, so out of proportion to the local lesion present as to necessitate the inference of a zymotic cause.

TABLE 8.—*Hooping-cough.*

CASE 1.—A delicate girl, æt. 1, whose sisters are at school, and have a cough suspiciously like hooping-cough, wakes up febrile after a few hours' sleep, at 8 p.m., April 4th, 1869.

Next morning she seemed well, but became hot again in the evening; after a sleep on the 6th there was constipation; on the 7th, thirst, and no appetite.

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[1] In one case a boy exposed both to measles and hooping-cough at a day school is first taken ill with measles, and afterwards the symptoms of hooping-cough appear; this might either be evidence of the longer incubation period of hooping-cough, or only of the less intensity of its invasion stage, and of the prepotency of measles. All the other children in the family had measles first and hooping-cough after, this being the order in which they were exposed to infection.

Day of illness.	Date.	Pulse.	Resp.	Temperature.	Remarks.
4	April 7	200	80	105·3° recto.	Dyspnœa.
5	„ 8	140	50	101·0° „	Congestion of right base.
6	„ 9	180	60	103·6° „	Crepitation.
7	„ 10	140	70	98·5° „	Loose râles.

On the 14th hooping-cough well marked, as also in four others of the family who had been ailing most of this time. On April 28th this child again has disturbed breathing, and deficient expansion of right base; on 29th dyspnœa; defective respiration below scapula; râles everywhere; crepitation at base of lungs; convulsions; pupils somewhat dilated, but act to light; fontanelle depressed; pulse 150; respiration 60; temperature 102·5°. On the 30th convulsions through the night; pupils inactive; temperature 103·2°; alæ nasi compressed in inspiration; death at 6 p.m.

At the commencement of this illness a remarkable fall of temperature accompanied the establishment of the local process in the lung on the seventh day. That the high temperature preceding this was not due to the lung complication, but part of the general disease, and analogous to what takes place in the early stages of all the exanthemata, is not only the most likely supposition from the facts of the case itself, but is made evident from the second of these cases.

Case 2.—A boy, æt. 4½, exposed to hooping-cough for ten days or a fortnight, is found, after slight symptoms of illness, to be febrile on March 18th.

Day of illness.	Date.	Pulse.	Resp.	Temp.	Remarks.
2	March 18	100	...	99·4° axilla.	Pulse full and jerking; to remain in doors.
3	„ 19	...	...	99·6° „	Coughed in the night.
4	„ 20	120	28	100·4° „	Seems dull and heavy; some loose cough, and wheezing heard.
5	„ 21	120	24	99·8° „	Face flushed; loose râles in larger bronchial tubes.

Day of illness.	Date.	Pulse.	Resp.	Temp.	Remarks.
7	March 23	108	22	99·2° axilla.	Sick before dinner, no appetite, the wheezing has gone; earache at night.
8	„ 24	130	...	102·0° „	Generally worse; not much cough; lips full, dry and red, face flushed; high fever in the night.
9	„ 25	140	40	103·4° „	Tongue white; worse at night; delirious.
10	„ 26	140	40	103·0° „	No râles nor defective respiration; perspired a little in the night; bowels and urine free.
11	„ 27	140	40	103·8° noon.	Three grains of quinine given in the afternoon reduced the temperature to 101·3°, and after a second dose it was 100·8°.
„	By 8 p.m.	110	30	101·3° recto.	Only 100·8° in axilla, a fall of three degrees in eight hours from 1½ grs. of quinine, or a fall of four and a half degrees of temperature in one day.
„	At night	100	30	100·8° axilla.	
12	„ 28	100	26	99·3° „	Moist rhonchi on deep inspiration.
13	„ 29	108	30	99·6° „	Respiration weak and irregular in rhythm, frequent cough; deafness; rhonchi on expiration.
14	„ 30	100	26	99·1° „	Earache.
16	April 1	100	26	99·4° „	Inspiration prolonged; no rhonchi.
19	„ 4	100	30	98·6° „	Coughs but little; is weak and thin.
21	„ 6	100	26	99·2° „	Constipation; takes cod liver oil.
24	„ 9	100	20	99·5° „	Regaining flesh; is easily tired.
34	„ 19	88	22	99·0° at end of six weeks.	Better; to go out.

The high temperature from the eighth, ninth, and tenth days of the illness was not owing to any chest complication nor to otitis; the ears were examined, and there was no deafness on either of those days. On the morning of the eleventh day the child was removed from the room, where the infant was suffering some of the worst effects of the disease, two drachms of brandy were also given without good effect. The quinine was not given until 2 p.m. An hour afterwards the pulse was much quieter, and reduced twenty beats in the minute. The child seemed roused from the lethargy of the previous two days, and wished to be read to; it was then noticed that some degree of deafness existed, and the voice had to be raised in reading to him. Two hours after he felt hungry, eat, and the sordes cleared from the lips. After the second dose of quinine he seemed more deaf, and fell asleep, the pulse then being only 100 in the minute, and the temperature had fallen three degrees, the greatest care being taken that this was obtained with absolute accuracy. The bowels were relieved naturally next morning, and the cough resumed its ordinary characters; the deafness had not quite disappeared before the second attack of earache.

This boy was not seen till March 18th, when he was dressed for going out, and was said to be quite well; but the quick, jerking pulse and elevated temperature showed the necessity for immediate rest and precaution. It is probable that his illness commenced at the same time as that of his two elder sisters, whose cases follow, and that the greater severity and continuance of the early stage of it, is chiefly owing to his greater exposure to the source of infection. The high degree of temperature maintained at the commencement of the second stage of the illness is evidently controlled by quinine.

The other children in this family were three girls; the youngest, a year and a half old, has a cough in February, attributed to teething. She was said not to be febrile, and was taken out daily till the beginning of March, when, the weather being cold, she was kept at home, and was consequently more with the other children. The boy was the only one who slept on the nursery floor, and he was in the same room with the infant. On March 8th the infant's cough, besides being spasmodic, was attended with some thin phlegm, which had not accompanied the former cough. On the 15th the child was seen with all the characteristics of hooping-cough.

On examining the sisters, the elder (Case 3), seven years old, apparently quite well, had a temperature below the normal; she sneezed at night, next day was fretful; pulse 100; respiration 26; temperature 98·6° axilla. March 18th.—Seems heavy, easily tires and cries, tongue pale, glandulæ concatenatæ a little enlarged; slight irritable cough, quick pulse; temperature 100·4° in the axilla. Next day more cough, glands of neck considerably enlarged; still febrile. 21st.—Cervical glands less in size, pulse quick; she is still febrile, but emotional, so that the temperature is not exactly ascertained. March 23rd.—Lively, good appetite, loose cough, glands of neck have subsided, temperature normal. The cough was not severe; it caused the face to redden, and continued for three weeks.

The younger sister (Case 4), three years and four months of age, had the first depression of temperature on March 16th, when she looked pallid, but did not feel ill. Next day the appetite was bad, the respiration shallow. The illness had commenced, and furnished the following observations:

Day of illness.	Date.		Pulse.	Resp.	Temperature.		Remarks.
					Noon.	Evening.	
3	March	18	120	28	...	100·6°	Tongue white, no cough, small glands in neck.
4	„	19	104	...	...	99·4°	Pallid, eyes heavy; breath short.
5	„	20	120	26	101·0°[1]		Râles developed on deep inspiration.
6	„	21	130	26	100·4°		Sonorous rhonchus; tongue white; lips dry, swelled.
7	„	22	110	28	99·2°		Loose sonorous rhonchus; seems ill, dull and heavy.
8	„	23	112	...	...	98·0°	Pallid; coryza, eyelids swollen, better.
9	„	24	108	28	...	...	Seems weak and languid; had earache in the night, and spasmodic cough, relieved by morphia.

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[1] Evidently not influenza; or the temperature would have fallen, or some more marked local effect have appeared ere this.

Day of illness.	Date.	Pulse.	Resp.	Temperature. Noon.	Temperature. Evening.	Remarks.
10	March 25	120	30	...	99·0°	Whoops with the cough, and wheezes.
11	„ 26	110	26	98·6°		Tongue clean, good appetite, cheerful.
13	„ 28	120	20	98·4°		Loose râles; better.
15	„ 30	104	26	98·5°		Râles developed on deep inspiration.
21	April 6	100	22	98·6°		Seems nearly well; coughs night and morning.
24	„ 9	...	...	99·2°		Is not disturbed at night; has a slight fit of coughing, with loose phlegm, in the morning; is taking cod liver oil, which, perhaps, increases the temperature.
45	„ 30	...	...	99·4°		Eyes redden on coughing; white mucus at back of pharynx.

The infant, Case 5, after nearly a fortnight's illness and a week's cough, whooped with it on March 13th. On the 18th the paroxysms were of great violence, and there was much secretion. An emetic with antimony in the night afforded some relief, but was followed by an increase of illness. Next day the face became almost black in the spasms of cough; in the interval air entered the lungs freely everywhere. The temperature at this time was 99·8°; on the 21st, 99·6°; 24th, 99°, with loose râles. On the 26th morphia in minute doses had diminished the expectoration, but was discontinued because of some crepitant râles at the left base, and a poultice was applied; at the same time the temperature was only 99·2°. On the 27th the temperature was 98·2°; the pulse was 120 in the minute; the respiration 36, and much freer. A combination of atropine and morphia, one sixtieth of a grain of each in sugar powders, was now used with most marked good effect, not only in moderating the spasm, but, at the same time in lessening the amount of the thin, acrid secretion. On visiting the child at night the pulse was 88, the respiration 30, the temperature *in recto* 98·7°, and on the surface not above the normal. On April 7th the cough and secretion were both increased by going out of doors; the temperature was 99·2°. On May 4th the cough was not lost, though there was but little expectoration; the temperature *in recto* was 99·4°. The eye teeth were near the gum, though not giving rise to much discomfort, and the child's health had much improved.

The treatment in these cases, unless otherwise stated, consisted of ammonia, lemon-juice, and the simplest salines.

The first febrile disturbance occasioned by hooping-cough has a tendency to subsidence on the eighth day, but is most variable, both in kind and degree. Sometimes, but not always, there is evident pulmonary implication, and then the kind of cough and illness that is to result is not altogether unexpected; at others there is little to forewarn and that little is often disregarded, the more so as nearly a fortnight may elapse before the paroxysmal cough is unmistakable.

Where there has been but one exposure to a source of infection, immunity is often hoped for and expected just before the symptoms are developed in full violence, and not unfrequently the disease is at this time unintentionally spread. Examples of the more insidious forms will now be adduced; other cases illustrate the temperature changes of the early stages; the last case but one shows the persistence of a high temperature in the latter stages of this disease; and finally, one case is given of fatal pulmonary complication.

Case 6.[1]—A boy, æt. 6 years, seems amiss on November the 15th and 16th, but not so much as to prevent him going to school every day. On the 19th he has a cough, and on the 20th a fine rash on the face and chest; he stayed at home without medical aid till the 24th, when he had loss of appetite and hardly any signs of rash. On the 26th the cough became spasmodic and the fine rash on the face became more obvious, with spots smaller and brighter than the mottling from measles. A brother, of nearly four years, has already loss of appetite; a pulse of 100, respiration 30 in the minute, and temperature 100° in the axilla. On the 26th wheezing, with temperature still above the normal: there was then but little to be complained of; the wheezing was only developed on forced inspiration. On the 28th the temperature was 98·6° in the axilla, and there was already some cough, not evidently hooping-cough, for another week or more, and then not very bad till in the severe weather of the early part of the new year.

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[1] The house in which these three children resided was made unwholesome by old brick drains in the basement.

Case 7.—A sister, æt. 2½ years, on the same day, November 24th, was dull, sleepy, and slightly febrile; she had slight diarrhœa on the 20th, and had not seemed quite well since. On November 25th the pulse was 120, the respiration 40, temperature 100·5° in the axilla; there was thin white mucus in the throat and the glands of the neck were perceptibly enlarged. On the 26th there were loose rhonchi audible over the whole chest, the temperature half a degree less, other conditions the same. On the 27th the evening temperature was 99·6°; on the 28th it was normal, the child was fretful, but the cough quiet. These children were at no time so ill as the youngest.

Case 8.—A boy, æt. 7½ months, nourished chiefly from the breast, apparently strong and robust, was seen November 22nd, because of supposed tooth irritation; the central incisors were not very forward, and the temperature, even in the rectum, was below the normal; next day he was said to cough and have short breathing, and the day after he refused food and would only suck a little at a time, but did not seem feverish till night, when very restless and burning hot. The two central incisor teeth were cut without difficulty early in March, no others appearing until the following November. At two years old a lateral incisor was cut, but neither the canine nor the last four molar teeth, though the child was well grown and had no signs of rickets.

Day of illness.	Date.	Pulse.	Resp.	Temp.	Remarks.
2	Nov. 25	200	80	102·6°	Air enters all parts of lungs; there are ten quick respirations every five seconds, and then a pause.
3	„ 26	200	70	104·0°	Alæ nasi work; dyspnœa relieved by night.
4	„ 27	180	80	102·2°	Respiration improved, moist râles are developed on deep inspiration.
5	„ 28	...	...	101·0°	Vomits with cough.
6	„ 29	130	50	101·5°	Coughs every hour in the night, high pitched rhonchi at right base.
8	Dec. 1	...	...	90·8°	Cough looser; fine petechiæ on skin.
9	„ 2	120	40	99·6°	Improving.

In the cold weather of the early part of this year the spasm with the cough became more violent. The child was kept more at the breast, while, at the same time, the mother had become disqualified (by menstruating on January 15th) for nursing. On February 10th a short febrile exacerbation gave a warning, which was not heeded. On March 12th there was a repetition of febrile disturbance. The child had become thin and weak, and on the 21st he was sick, constipated, feverish, with cough and wheezing, and the following illness:

Date.	Pulse.	Resp.	Temp.	Remarks.
March 22	160	40	103·0°	Large rhonchi, no defective breath sound.
„ 23	140	40	101·0°	Vomits; wakeful, excitable.
„ 24	120	40	99·4°	Crepitation over a definite spot at base of right lung.
„ 27	120	35	98·6°	Below the normal in the axilla, though there is a spot at the right scapula where there are tubular, high-pitched rhonchi and deficient breath sounds; after being suckled much at night he vomited and became feverish, and the next day he was ordered to be weaned.
March 29	140	50	101·5°	Congestion of left as well as of right base.
„ 30	140	56	101·2°	Crepitation at right scapula only, left lung healthy.
„ 31	...	...	99·0°	Perspiration; has not been to the breast again
April 1	Not febrile.			Small petechiæ visible on neck and chest.
„ 10	...	...	99 0°	Improving; respiration clear.

Some symptoms of hooping-cough had continued throughout, and were increased by going out of doors on March 19th, but little signs of it remained in this last illness, during which on two occasions, probably from a defective state of the mother's milk, a sharply febrile attack has terminated in congestive deposit, and even inflammation of a limited part of the lung, coincident with a subsidence of temperature almost to the normal. Besides the theoretical analogy of this to what occurs when free secretion results, the practical import of it is, that a comparatively low temperature does not exclude mischief, for on neither of these days, March 24th and 31st, would the temperature have sufficed to indicate the state of the lung.

Case 9.—A boy, æt. 9, going to school as a weekly boarder, comes under notice February 23rd with hæmorrhage from the bowels. He has been at home three days with a cough, and he was noticed to cough suspiciously the week before. Two little sisters, æt. 3½ and 2, when first seen on February 25th, had coughs which excited a suspicion of hooping-cough, the more so as they had come on without the signs of ordinary cold. On the 28th the youngest had whooped, the cough was violently paroxysmal; some large, loose rhonchi were audible over the chest, chiefly consonant with the larger bronchial tubes; a slight elevation of temperature, hitherto noticeable, had subsided. Both children had the cough badly for the next week or two; some violent paroxysms in the younger child were cut short by minute doses of antimony.

Case 10.—A brother, æt. 6, much with the elder boy since the 19th, did not seem to be quite well on the 25th, but was without cough; the first permanent molars were near the gum, and his temperature was below the normal. A slight cough was first observed on the 27th, when the axillary temperature was 98·6° at noon, and 99° at night. On February 28th the temperature was 99·4°, pulse 100, respiration 24, the tongue whitish, no appetite; there was glairy mucus at the back of the pharynx. This slight degree of pyrexia continued until March 5th, when the temperature at night was only 99° in the axilla; the slight acceleration of pulse, and the somewhat spasmodic cough causing the face and eyes to redden but resulting in very little expectoration, being the only signs of illness. There was still glairy mucus in the throat, the tongue was cleaner, and the appetite had returned since March 2nd. On March the 8th the cough had become more characteristic, the breathing was slow and shallow, but a deep inspiration developed some moist râles in the smaller tubes; the pulse continued to be quick, but the temperature had become normal; it was 98·3° in the axilla. During the month an elevation of temperature was, however, frequently met with. On the 30th it was 99·6° at 4 p.m.; the cough dry, and causing flushed face; he had sometimes trouble from tenesmus, and was noticed to be readily fatigued.

The next case presents features of unusual gravity.

Case 11.—A girl, æt. 5, whose brother is attending a day-school, and has had cough for some time, is seen on March 23rd with catarrhal symptoms said to be of a week's duration; and, though suspected to be from hooping-cough, the general illness during the next four days was sufficiently severe to arouse doubts both as to cerebral disease and fever.

Date.	Pulse.	Resp.	Temperature. Noon.	Temperature. Night.	Remarks.
March 23	...	...	99·0° axilla	...	Coryza; cough, with sickness.
„ 27	100	26	...	99·8° recto.	Lips dry and swollen, frequent vomiting.
„ 31	120	40	99·5° axilla	...	Somnolence, great prostration.
April 2	108	30	99·0° „	...	Earache; violent cough, dusky face, swollen lips.
„ 4	100	30	99·8°		Bloody mucus, both with expectoration and vomiting.
„ 6	100	34	100·5°		Small doses of morphia gave no relief to cough and are not to be repeated; large rhonchi at right back, râles everywhere.
„ 7	180	36	102·5° recto		Large liquid rhonchi, some of high pitch; sputa viscid and opaque; conium and ammonia given.

Date.	Pulse.	Resp.	Temperature. Noon.	Night.	Remarks.
April 9	120	40	102·0° axilla		Less expectoration, cough violent; takes atropine and morphia.
„ 10	...	...	102·4° „		Thick expectoration mixed with blood, blood in the stools and vomit; respiration freer; to take chloral at night.
„ 11	130	40	103·0° recto		Takes but little nourishment, and retains scarce any.
„ 12	120	40	102·5° axilla		Had sleep after third ten-grain dose of hydrate of chloral.
„ 13	quick, feeble	...	101·4° „		Less sick; chloral to be given at night.
„ 14	...	...	101·7° „		Slept better; cough and expectoration rather less.
„ 15	130	42	...	103·3° recto.	Bowels relaxed; cough; more points of blood in the mucus; chloride of aluminum administered in the form of spray.
„ 16	120	36	...	101·6° axilla.	Less blood in the expectoration and vomit; to be carried out of doors.
„ 17	110	30	...	99·0° „	Ate meat; no blood in the stools.
„ 18					Much improved. Temperature 98·9 axilla at 6 p.m. Some large mucous rhonchus heard in coughing.
„ 19					Doing well; coughed frequently in the night; small streaks of blood only in the pharyngeal mucus at the end of coughing.
„ 20					5 p. m.; temperature 99·4°; loose cough, troublesome only at night; no blood in the expectoration; complexion healthy; takes cod-liver oil.
May 10					Quite well; no cough except, perhaps, once towards morning.

The following fatal result of hooping-cough closes these observations:

Case 12.—A girl, æt. 1¼, having suffered from hooping-cough for six weeks or more, is seen on April 18th suffering from extreme dyspnœa, with signs of pneumonia of the left lung. The pulse and respiration were too much disturbed to be accurately recorded.

Date.	Temperature.			Remarks.
	Morning.	Night.		
April 18	...	104·0°	recto	Face livid, ensiform cartilage retracted in inspiration, fine dry crepitation over left lung.
„ 19	99·6°	101·2°	„	Administration of brandy of some benefit.
„ 20	101·0°	100·8°	„	Loose râles, moist crepitation, much mucus expectorated.
„ 21	101·2°	102·0°	„	Return of dry crepitation and of dyspnœa, dulness of left back, lips livid.
„ 22	Death at 8 a.m.			

The only temperature-observations in hooping-cough that have come under my notice, beyond the instance given in my last paper[1] (where 104° was reached, with convulsions and recovery), are those of Dr. Henri Roger;[2] they are sixteen in number, taken in three cases, and fairly indicate what is found in these more extended investigations. Associated with slight bronchitis a temperature of 100·5° is recorded, with very intense bronchitis 102°; without complication the lower range is about 99°; the highest temperature met with was 103·5° in a case where abscess of the lung and cerebral ramollissement co-existed.

In the ordinary course of hooping-cough the temperature variations resemble for a time those tabulated in the case of influenza, corresponding closely with what is observed both in influenza and in croup; but these two diseases, *identical in themselves*, differ essentially from hooping-cough in being suddenly febrile, while the pyrexia preceding the latter is always of some days' duration, and is most marked in some of the most insidious cases. This also is noticeable of diphtheria, and forms a chief means of establishing the essential difference between it, scarlet fever, and croup. The early stage, both of hooping-cough and diphtheria, though obscure and often overlooked, is probably the only part constant and inevitable. At this time treatment may be powerless to avert disease, though most powerful in guiding it to a favorable termination. In neither disease is the virulence of the infectious products so great at first, as it becomes in the later stages; even then, the amount of infection is very much as the amount of morbid secretion formed; and as whatever limits these secretions also limits the amount of disease present, an opportunity is afforded for medical treatment to check the effects, if not to shorten the duration, of the disease.

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[1] "Infantile Temperatures," p. 27. 'Trans. Obstet. Soc. London,' vol. x, p. 296.

[2] "De la Température dans les Maladies de l'Enfance." 'Arch. Gén. de Méd.,' p. 301, t. vi, ser. 4, 1844.

Tuberculosis checked by quinine.

A boy, æt. 12, height fifty-one inches, after a cold in the spring, has loss of flesh and some chest affection with deficient expansion of the left apex on April 28th, when the pulse is 120, respiration 30, and the temperature 98·4° in the axilla. On May 2nd, though there is perspiration, shortness of breath, pallor, and loss of appetite, the pulse is 80, respiration 28, and the temperature in the axilla only 98·2° at night. Country air and cod-liver oil did some good. In August the pulse and breathing were again quick, and the axillary temperature was 99·1° at noon. Change of air now did no good, and in November the day temperature was generally 99°, and the night temperature 101·5° to 102°. The rise of temperature would begin at an early hour in the afternoon, whatever the care as to quietude and diet; nor was the evening hectic checked by rest, by stimulants, or any of the means directed against the evident deposit, and its commencing alterations in the left apex of the lung.

On December 6th and 7th five grains of quinine given in solution rapidly arrested the night fever; by the time the daily dose of quinine had reached ten grains, the evening exacerbation was entirely prevented, and from that time the boy gained in flesh and strength; a year afterwards he continued in good, though not robust, health.

Meningitis,—though not without elevation of temperature through most of its course, and subject to a sudden and great increase before its fatal termination, yet in the last case given in the table the temperature was found to be below the normal on the day before death, which seemed to result from great effusion of serum and consequent pressure.

Table 9.—*Tubercular Meningitis.*

Case 1.—A boy, æt. 4 months, after slight drowsiness and constipation, on April 10th has a convulsive seizure in the night

Day of illness.	Date.	Temperature. Morning.	Temperature. Evening.	Remarks.
2	April 11	100·0° recto	101·0°	Convulsive twitchings all day.
3	,, 12	104·0° ,,	103·6° axilla.	Pupils not contracted, temperature not reduced by cold affusion.
4	,, 13	Death.		

Acute hydrocephalus; remarkable fall of temperature before death.

Case 2.—A girl, æt. 1¾ year, after four days' vomiting is partially unconscious on the fifth day, and delirious at night.

Day of illness.	Date.	Pulse.	Resp.	Temperature.		Remarks.
6	Dec. 30	80	20	100·2° recto	98·6° axilla.	Dilated pupil.
7	,, 31	irregular		100·1° ,,	98·4° ,,	Coma.
8	Jan. 1	120	30	100·4° ,,	...	Surface cold.
9	,, 2	weak, irregular		98·2° ,,	97·0° in folds of abdomen.	
,,	At night		...	100·0° ,,	...	Limbs cold.
10	,, 3	Death. Some heat of surface before death.				

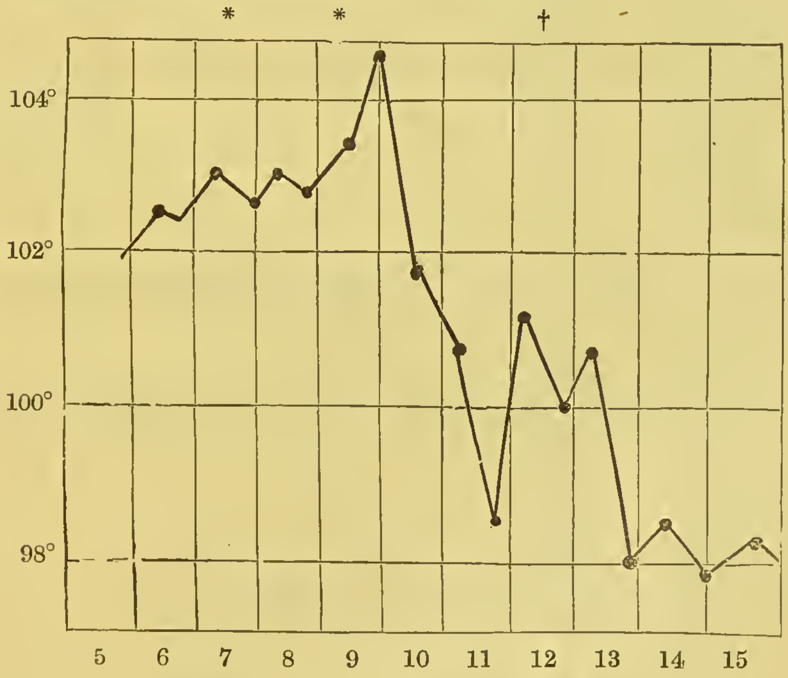
I remember much anxiety and doubt as to whether some early head symptoms in a child might be owing to tubercular meningitis or to typhoid fever, a question which at certain stages can readily be decided by temperature. This is well illustrated by a case of typhoid fever in an infant of sixteen months old, for which I am indebted to Dr. Hare.

TABLE 10.—*Typhoid Fever.*

CASE 1.—An infant, æt. 16 months, has diarrhœa, and high temperature with evening exacerbation for a week.

Day of illness.	Date.	Temperature in axilla. Morning.	Temperature in axilla. Evening.	Remarks.
7	March 14	...	103·0°	Rose spots.
	„ 16	...	103·4°	Ditto.
10	„ 17	104·8°	101·8°	
11	„ 18	100·8°	98·4°	One or two fresh spots.
12	„ 19	101·0°	100·0°	
13	„ 20	100·8°	98·0°	
14	„ 21	98·4°	97·8°	

This case is thus represented in diagram.



* Rose spots. † One or two fresh spots.

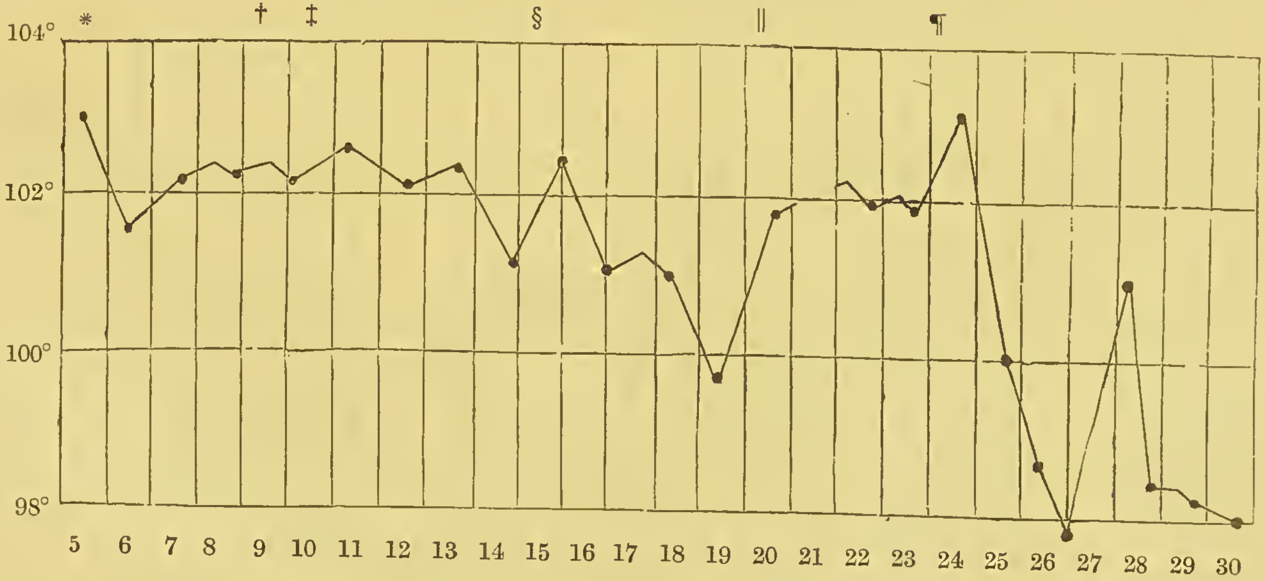
For the details of the following case I am indebted to my friend and former pupil, Dr. Buckell, of Islington. Diagrams of this and of another case in an older girl under my care, in which there was no diarrhœa, are given for comparison with the somewhat anomalous case in the last diagram.

Case 2.—A girl, æt. 8, was seen after about a week of malaise and anorexia. Complained of pain in abdomen; on pressure gurgling was elicited in left iliac fossa; tongue was pyrexial in character.

Day of illness.	Temp. Noon.	Remarks
7	103·0°	Four grains of cinchonæ sulph. given in twenty-four hours.
8	101·8°	Ditto.
9	102·2°	Ditto. Diarrhœa very severe.
10	102·4°	Ditto. Rose spots appeared.
11	102·4°	Ditto.
12	102·8°	Ditto.
13	102·2°	Ditto.
14	102·6°	Tongue became brown; stimulant given with cinchona.
15	101·2°	Ditto.
16	102·6°	Ditto.
17	101·2°	Ditto.
18	101·2°	Ditto.
19	99·9°	Ditto.
20	102·0°	Increase of anorexia.
21	101·2°	Vomiting came on; cinchona stopped, nourishment and stimulants given by bowel, nothing by mouth.
22	102·1°	Ditto.
23	102·0°	Ditto.
24	103·4°	Cinchonæ sulph. gr. viij given by bowel in twenty-four hours.
25	100·1°	Ditto.
26	98·8°	Ditto.
27	97·4°	Ditto.
28	101·2°	Ditto.
29	98·4°	Ditto.
30	98·2°	Cinchona stopped; mineral acid given by mouth.
31	98·0°	

Typhoid fever diagrams.

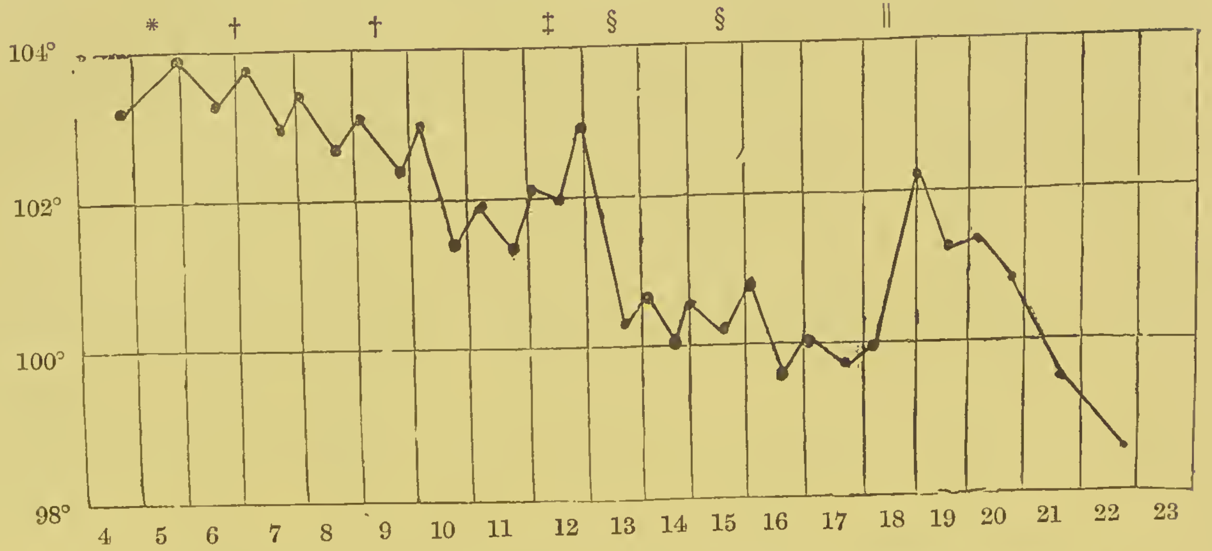
Case 2.—A girl, æt. 8, seen after some days' illness.



* Four grains of cinchonine daily. † Diarrhœa. ‡ Rose spots. § Stimulants given.
|| Omit cinchonine. ¶ Resume cinchonine.

Typhoid fever without diarrhœa.

CASE 3.—A girl, æt. 16, seen on the fourth day of illness.

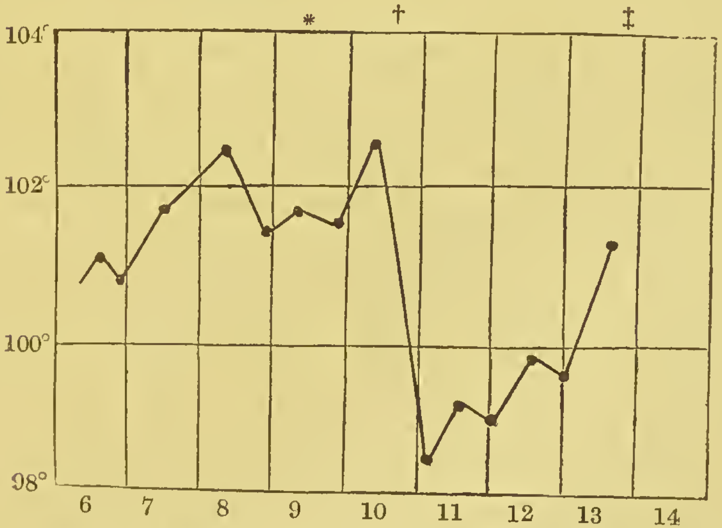


* Bronchial irritation. † Quinine given at night. ‡ Rose spots, abdominal pain.
§ Hæmorrhage from bowels. || Phlebitis in one leg.

Case 4.—A girl, æt. 8½ years, after being ten days at the seaside in hot weather, but in healthy lodgings, takes aperient medicine unnecessarily. She feels tired and weak afterwards; the next day is fatigued by being too much out of doors, and becomes feverish at night; for six days she continues to be taken out, though the fatigue, fever, and loss of appetite increase.

Day of illness.	Pulse.	Resp.	Temperature, axilla.		Remarks.
			Morning.	Evening.	
8	110	27	...	102·2°	Has travelled home by railway; ordered to bed.
9	100	30	101·6°	102·4°	No action of bowels; two lenticular spots on abdomen.
10	108	32	...	102·6°	Red spots very numerous; bowels inactive.
11	100	30	98·2°	...	Spots fading; constipation relieved.
12	...	...	100°	...	Some fresh spots on sides of chest.
13	110	32	...	101·2°	One or two new spots behind the shoulders.
15	100	30	...	99°	Bowels inactive.
21	...	...	...	...	Looks well; appetite returned.
30	...	...	...	...	To return to the sea.

Infantile remittent or gastric fever; constipation.



* One or two lenticular spots on body. † Numerous spots.
‡ One or two spots on shoulders.

CASE 5.—A boy, æt. 3½ years, brother to the last, went to the seaside the day before the sister was ill; she came to him, but they were not much together; three days after he is sick in the morning, and his bowels disturbed twice; next day and the third day he is dull and languid, with no action of the bowels, and considerable fever.

Day of illness.	Pulse.	Resp.	Temperature.		Remarks.
			Morning.	Evening.	
4	...	...	High		Castor oil acted twice; second relief is almost black.
5	108	30	...	101·4°	Has travelled home; yawns frequently; a sore spot on edge of mouth.
6	112	28	100·1°	...	In bed; tongue cleaner.
7	100	26	98·6°	...	Herpetic spots on lower lip; red spots seen on abdomen.
8	...	...	98°	...	Numerous red spots, like the sister's, over body; one light coloured relief from the bowels.
10	...	...	...	98·2°	Bowels are not quite right.
12	...	...	...	...	Better; appetite good; bowels natural.
15	...	...	98·9°	...	Slight diarrhœa for two days; to-day dysenteric; tongue pale, with thin fur.
21	...	...	...	...	Cheerful and well; pale; to return to the sea.

These cases are somewhat anomalous; the absence of diarrhœa, as shown in the case which precedes them, is not enough to distinguish them from typhoid; a sudden remission may occur in undoubted infantile typhoid. The lenticular spots could not without hesitation be called "rose spots;" they differed from those of typhoid in being more acuminate and less completely effaceable under pressure. Nothing can here be affirmed of the identity of infantile remittent and typhoid, for these cases were not altogether identical with what is generally termed infantile remittent, though had not perfect rest in bed been enjoined for some time after the first remission doubtless the febrile disturbance would have returned. The second case can hardly be classed with the mildest form of typhoid, yet the two cannot be dissociated.

Diagnosis.—The value of temperature observations in diagnosis can now only be slightly touched upon. While readily conceding the merit of priority to M. Henri Roger,[1] some credit is claimed for having shown that the temperature variation of infants follows the same rules, and is within the same limits as that of adults, and therefore becomes as serviceable for purposes of diagnosis.

Typhoid fever, in its ataxic form, when it presents the greatest resemblance to meningitis is, as has been shown, readily discriminated from it by temperature. In the sthenic form of typhoid fever, an intercurrent bronchitis or pneumonia is accompanied by a greater temperature-disturbance than would be caused by either of these complications, while the disturbance of the pulse and respiration is less than that met with in simple pulmonary disease. Dysentery and enteritis are readily distinguished even from the slighter forms of typhoid by their lower range of temperature.

In scarlet fever, though the disturbance of temperature is often extreme, it is insufficient for diagnosis, or even for discriminating between it and a disease so nearly allied as influenza. In scarlet fever a temperature as low as 99° has been met with on the second day in a vigorous subject, with full rash, ending on the third week in desquamation : in influenza, with no other complication than full tonsils, the temperature may continue at 101° till the fourth or fifth day; with ulcers on the tonsils, or herpes of the lip and face, the temperature on the second day may even exceed 103°, and has been found at 102° on the third ; a temperature less than this, generally very near 100°, is met with in the diffused bronchial irritation with which the more ordinary attacks of influenza begin ; in both forms the difficulty of diagnosis may be increased by the presence of a finely diffused rash[2] on the chest and neck, either with the first symptoms of illness, or appearing after the application of the warm linseed poultice so useful for their relief.

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[1] "De la Température chez les Enfans a l'état Physiologique et Pathologique." Par Henri Roger. 'Archiv. Gen. de Méd.,' 4me série, tom. v, p. 273. Paris, 1844.

[2] Of the two illustrations given of mild scarlatina the boy's case is probably of this kind; that of the girl was undoubted scarlet fever.

A low temperature is often sufficient to enable a diagnosis to be speedily arrived at that must otherwise be uncertain or be delayed; a lad exhausted by fatigue and exposure has been found with symptoms that might have indicated either typhoid or scarlet fever except for this test. In laryngismus stridulus, as elsewhere stated, the low temperature invariably accompanying the associated states of irritation and defective nutrition, at once serves to distinguish the spasm from laryngitis, or from an affection symptomatic of serious organic disease.

It is seldom that a single temperature observation could or should be made the basis of a diagnosis; moreover we must remember that it is not to show what the *disease* is, but *how it affects the patient* that temperatures are taken. We have other means of diagnosis that special training must teach, to let us know what form of disease is present. To learn how the individual will bear it is the result of an experience difficult to impart; yet to know this is of as much importance, at least to the patient, as to know the name of the disease, and it is this knowledge which every temperature observation in some degree affords us; yet even here a series of observations is requisite, and experience must give them their value.

Elevation of temperature is useful as indicating the presence of disease generally. How often have the indications of the thermometer afforded the first revelation of unsuspected disease, pneumonic consolidation for example.[1] Absence of disease cannot, however, be affirmed because the temperature is not, at a given time, increased; many diseased processes end in a local process not always accompanied by high temperature; indeed, a low temperature has been found with quite recent congestion of the lung. On the other hand there are times of life and states of system, when we meet with sudden rises of temperature not always betokening danger, but only the necessity for care. This is sometimes seen in the puerperal state from only a cracked nipple. In the period of most rapid growth in childhood there is a tendency to just such a state; the presence of a tooth at the gum, or of worms in the intestine, may excite it, but it has no special connection with teeth or with worms; it will occur as readily after all the first teeth are through the gum as before; it is referable to diathetic peculiarities, bad air,[1] bad nutrition, a wrong or defective food, and to rapid growth. Instances have occurred to me of a child growing ten inches in the first year with backward dentition, and only three inches in the second year: another, of slow growth in the first year with forward dentition, and a growth of seven inches in the second year. With this rapid growth, and with some instances of suddenly high temperature in other conditions, has been found associated *gastric* rather than pulmonary congestion, and it is in this association that the benefit said to result from the use of a mercurial aperient has generally been obtained.

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[1] It has frequently occurred to me to see children forced to exertion, and sent out (especially at the seaside) when a single temperature observation would have shown the necessity for rest, and have guarded against much consequent illness.

Therapeutics and hygiene.—During any considerable elevation of temperature sleep is impossible, nutrition is interrupted, and waste increased; indeed, in a continued high temperature the tissues of the body not only waste, but are destroyed. Hence, empiricists have sought for remedies to reduce temperature; but the high temperature is a direct result of the diseased action present, and these remedies, which are useful in reducing dangerously high temperatures are those which have a controlling power over the disease, so that temperature may be a test of the suitability of a particular kind of treatment to the disease present. Hence the benefit of cold affusion and quinine in typhoid and scarlet fevers. Since using quinine in the early stages of the latter, whenever there was a tendency to a high night temperature and consequently to nocturnal delirium, the temperature has never reached so high a point as it frequently does when not checked in this way. This effect is equally remarkable in diphtheria, where the nocturnal delirium (so often noticed to occur in children, who, as Fothergill remarks, were quiet and sedate in the day) is a result of the evening exacerbation of temperature. The effects of quinine in this way are very marked in the early stage of these diseases, but it has no such influence in their later stages; not only this, but chloral, generally of service in hooping-cough, caused no lowering of temperature in one case, where the use of a weak solution of chloride of aluminium 15 grs. to 1 oz., used in the form of spray, by exerting a favorable influence on the condition of the respiratory tract, resulted in a diminution of temperature; the same thing has happened where the cough and the expectoration have been lessened by a combination of morphia and atropine.

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[1] A high temperature is not only induced by the specialized poisons such as cause scarlet fever or influenza, but the emanations from bad drains will often cause a sudden rise to a temperature as high as 104° or 105°, which, however, may subside without serious consequences.

Cinchonine has been found to have precisely the same effect as quinine; the muriate of cinchonine is cheaper, the powder in any dose is easily given in wafer paper, it readily dissolves with a very little hydrochloric or phosphoric acid, and is readily taken mixed with water and glycerine, to which a little chloric ether may be added. By means of cinchonine and quinine, in five- or ten-grain doses, the night fever of tuberculosis has been stopped; more than once has tuberculosis itself been arrested; the febrile stage of many diseases may thus be shortened or greatly controlled, and not only discomfort but danger avoided: indeed, what is effected by this remedy in ague is in some degree effected by it in other febrile states, the tendency to high temperature is checked and at length overcome.[1]

On the other hand, a marked increase of temperature results when the "eliminating" treatment is followed too closely.

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[1] In the admirable essays of M. Henri Roger already referred to, 'On the Elevation of Temperature occasioned by Disease,' it is asked at the commencement, "Est il, parmi tous les mystéres de l'economie humain, quelque chose de plus digne de notre attention que cette force mystérieuse créé par la maladie?" In answer, we may compare with it that power from the vegetable world often great enough to control it, which is mysteriously created in the cinchona plant.

In the diseases here under consideration dilute the poison by all means, by pure air especially, and favour the subsidence of the diseased action. To eliminate a poison, if that were possible instead of eliminating the fluids of the body, we must remember that the quantity of poison eliminated can only be in proportion to the diseased action present, so that the diseased action must be increased in the process; moreover, if the last shred of desquamated cuticle in scarlet fever be infected, surely the last atom of living tissue must be, and if the body could be reduced to this and then restored, it would be restored in its state of scarlet fever, and resume the processes peculiar to it till they were accomplished.

Some points of hygiene are elucidated by temperature, to which there is barely time to refer. Dr. Finlayson has called my attention to a greater lowering of night temperature in children than my own observations bear out. Where I have found a temperature as low as 97° in the night, I have also found a low range of temperature in the day, and there seems to be a special connection between this and a dislike or a deprivation of fatty food. In a collection of facts any conjecture is an error, yet it is possible that this point might be eventually found useful in correcting the diet tables of workhouses and schools.

The following appendix of extreme and mean temperatures in some diseases of children may be of use :

Temperature in—	Lowest.	Highest.	Mean.
Pneumonia	...	105·8°	...
Pleurisy	99·0°	104·0°	101·5°
Peritonitis	98·7°	105·0°	103·0°
Dysentery	99·2°	101·2°	100·7°
Enteritis	98·7°	102·5°	99·0° or 100·0°
Pericarditis	100·5°	103·5°	101·5° in two cases with rheumatism, and one after scarlet fever.
Stomatitis	100·0°	102·0°	
Thrush	95·0°	102·4°	
Meningeal tubercle	98·0°	102·0°	...
Meningitis	95·?°	106·0°, once 108·4° just before death.	
Smallpox	98·7°	106·0°, once 105·0° the day before the eruption.	

These figures, excepting the result of fifty observations in pericarditis, and one in smallpox, are from the essay of M. Henri Roger, in which there is hardly a statement that has not been unintentionally verified in the course of inquiries which had been carried out independently and in ignorance of the good work there extant. At the conclusion of these essays M. Roger insists on the efficacy of the external use of cold water, whether by means of the douche, the sheet, or the bath, in moderating the severity, and even influencing the course of typhoid fever; this deduction of French science has been confirmed by the results of German practice, though the lapse of a quarter of a century has been necessary to establish it as one of the chief therapeutical results of that period.

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THE PERIOD OF INFECTION
IN
EPIDEMIC DISEASE.

"Hinc itaque cernere est variam admodum et accuratam Naturae methodum, quam ad morborum generationem adhibet; quam nemo hominum (arbitror,) hactenus pro rei dignitate satis observando est assecutus."—SYDENHAM, *De Morbis Epidemicis.*

THE

Period of Infection in Epidemic Disease.

[*Revised 1887, from Epidemological Society's Transactions for 1873.*]

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THE first object in collecting the following observations was to define with all possible accuracy the interval between the reception of infection and the appearance of symptoms in some of the more common epidemic diseases. This interval, the incubation period, instead of being uncertain, unimportant, and almost without symptoms, has been found to have definite symptoms, a great influence on the spread of measles, whooping-cough, and diphtheria, and a duration sufficiently constant to be of generic value in the classification of disease.

The study of all that pertains to the ingress of disease can only be said to commence with the last century. Dr. Richard Mead, in his Essays on Poisons, published in 1702, calls attention to the long period of latency in rabies. In a later essay* the whole argument as to contagion is as fully stated as in any recent discussions on cholera or typhus; sudden attacks of the plague, attributed to fright, he traces to infection; he says "contagion is a real poison," and afterwards remarks† that the practice of inoculation "shows that the small-pox does not break forth before the eighth or ninth day from receiving infection." Till this was known, terror at the swift stroke of plague had impressed people with the idea that all illness was sudden, so that hydrophobia, small-pox, measles, as well as all ordinary ailments, were commonly thought to be owing to the last thing that seemed strange because it did or did not happen.

The shortness of the incubation period in scarlet fever affords a ready means, still serviceable, of distinguishing that disease from measles. These diseases, carefully separated in descriptions since the time of Sydenham, are sometimes confused in practice now as they were then. The existence of a third exanthem, rubella, evidently as prevalent at that time as in our own, increased some difficulties which, owing to epidemic roseola having been recently used as a synonym, we have not yet escaped. Richard Morton (ΠΥΡΕΤΟΛΟΓΙ'ΑΣ 1694) considered scarlet fever to differ only from measles in the appearance of the rash, and to be wholly the same disease; he gives ten cases under the former heading, nine being measles, while the name of confluent measles is emphatically applied to an eleventh history* really relating to scarlet fever. At that time every severe and fatal case was referred to measles, scarlet fever being specially constituted, by definition only, a mild disease hardly deserving of classical nomenclature.

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* *A Discourse on the Plague*, London, 1720.

† *The Medical Works of Richard Mead, M.D.*, 4to, London, 1762, p. 317.

The epidemic increase of scarlet fever in the eighteenth century, and its association with malignant sore throat, attracted the attention of such men as Huxham, Fothergill, Cullen, and Heberden. The ill effects following upon a treatment in this fever, that had been harmless in measles, pointed to an absolute difference in their nature. Measles had always been so closely associated with small-pox that it was assumed to require a similar period for development, and it soon became evident that scarlet fever, like plague, could be quickly communicated. Dr. Withering† determined that the rash would appear on the third or fourth day after contagion; Dr. Blackburne‡ says it may occur from four to six days after; Heberden§ mentions the fifth day; and Dr. Willan‖ considers the sixth day as the latest for its occurrence. Whether rash be, or be not, an early symptom, scarlet fever begins soon after infection—possibly within two days, and not beyond a week. Where *epidemic roseola* is said to have this short incubation period, a suspicion of scarlet fever arises. The idea of a hybrid between measles and scarlet fever could only have arisen in the loose phraseology and looser thought of a time now passed. There is no half-way point between these diseases, and rubella is distinguished from scarlet fever by its long period of incubation. The want of a distinctive name, evident in my article on Rosalia (*British Medical Journal*, 1870, vol. i, p. 99), was supplied by me at the International Medical Congress of 1881, in London.

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* *Op cit.*, pp. 71-87.

† *On Scarlet Fever and Sore Throat*, p. 61.

‡ *Facts and Observations concerning Scarlet Fever.*

§ *Commentorii*, p. 20.

‖ *Diseases of the Skin*, p. 255.

The practical bearing of this part of pathology was first appreciated by Dr. Maton* at the commencement of the present century; to him is due the credit of recognising as a separate disease, on account of its length of incubation, the rubeoloid exanthem only now receiving a definite position. Dr. Mason Good,† who considered the quality of contagion in disease as "a doubtful and perhaps an inappropriate ordinal character," far from admitting this ground of distinction, classed Dr. Maton's cases as rosalia with scarlet fever, instead of referring them to the *rubeola sine catarrho* of Willan or the spurious measles of Richard Morton.

Dr. Maton had several times seen cases called either scarlatina or measles in which the symptoms were so trivial that he could not decide as to their nature. He says: "If scarlatina be mistaken for rubeola (for instance), or *vice versâ*, the consequences may be fatal, since the treatment suitable to the one must commonly be quite opposite to that required by the other; their distinction must not be placed on the external characters, for though the eruption may be the same in appearance, "the shortness of its duration, and the absence of all symptoms which could deserve to be denominated those of debility, made me resolve to keep a scrutinising eye on all similar cases."‡ He writes:—

> On August 18th, 1813, Miss F. C., aged 13 years, had this rash, her face was suffused with innumerable points, but she did not feel ill; her sister, K. C., aged 20 years, with her at the time, was complaining, and next day had the rash; the state of the tongue and the obviously slight character of the illness pointed to roseola rather than to scarlet fever. Four others of this family were in the room with these two sisters, and were it a contagious disorder separation would be too late. Of these four children, two girls, of the age of 10 and 15 years, had the rash on the 4th and 5th of September; a brother, Josh. C., aged 17 years, and a visitor, Miss R. C., aged 15 years, both had it on the 7th. Mr. C., aged 24 years, the eldest of this family, was taken on Sept. 24th, when absent from home; his infant son, aged 1½ year, showed it on September 30th; fulness and induration of the small cervical glands was noticed; and two of the girls did not quite recover their health for two months.

Dr. Maton remarks: "There is only one other exanthem that I know to which these cases can be considered referable, that is, roseola; but tumours do not occur in roseola, nor is it infectious. The period intervening between the application of the infectious influence and the commencement of the disease was considerably longer than has been noticed in scarlatina. Hence it seems requisite to form a new designation, which, however, I do not venture to propose at present, being satisfied with calling the attention of my colleagues to the subject."*

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* "Some account of a Rash liable to be mistaken for Scarlatina." By William George Maton, M.D., F.R.S., Physician Extraordinary to the Queen, *Medical Transactions*, published by the College of Physicians in London, vol. v, p. 149, London, 1815.

† *The Study of Medicine.* By John Mason Good, M.D., F.R.S., in four volumes, London, 1822, vol. ii, p. 545; or vol. iii, p. 4, of second edition in five volumes, London, 1825.

‡ *Op. cit.*, p. 151.

An analogy is observable between the action of the infectious poisons of fevers and the poison of rabies, which is only communicable by inoculation, and probably depends on some undetected microphyte. This analogy may be extended to many intermediate diseases, whether dependent on specific bacilli, or the organisms of erysipelas, pneumonia, purulent ophthalmia, and probably diarrhœa and catarrh; or, as in the septic states most under the control of Listerism, to micrococci with intensified or acquired toxic powers. There are, also, animal poisons from without, such as that of snake-bite, or those arising within the body, as uric acid, the ptomaines, and the rheumatic ferment, or the more limited product, cancer, not productive of epidemic disease:—but, in one year 20,000 deaths from snake-bites are recorded in our Indian population.

The agent in malarial fevers is probably a vegetable spore not dependent upon its human *habitat* for acquired virulence or multiplying power, yet not necessarily arising *de novo* where it is chiefly found. The isle of Bourbon—Réunion—is said, on French authority, to have been free from remittant fever until plants and earth from Mayotta were introduced. It would seem as if such spores, raised with moisture in evaporation, could be carried some not very great distance and re-deposited with dew or snow. The dust that has fallen on to ships at a great distance from land, whether volcanic or meteoric, has not been followed by any outbreak of disease. Side by side with the experimental enquiry, begun by Davaine and carried on by Pasteur, Klebs, Lister, Sanderson, and others, as to the nature of disease-germs, it is well to place such views as to the natural history of disease as result from accumulated clinical study and experience.

When, with Sydenham,† we consider the sources of all the air-borne poisons, we find this secret condition of the air is conferred by no chemical vapour, whether mineral or vegetable, but by the presence of living organisms. Very near a potential germ theory, he noticed how, in obedience to laws regulating all organic growth, "some vernal epidemics appear early, as in January, and thence, gradually increasing, come to their state about the vernal equinox; after which they gradually decrease, and at length disappear about the summer solstice. Others, rising in the spring, and daily increasing, come not to their state till about the autumnal equinox, after which they gradually decrease and vanish at the approach of winter."

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* *Loc. cit.*, p. 165.

† Thomæ Sydenham, M.D., Opera Omnia, Londini, 1844, Sydenham Society edition, p. 28, cap. 1, § 6.

Sydenham, though apparently unaware that small-pox was contagious, justly attributed epidemic diseases "to a latent and unexplained alteration of the air infecting the bodies of men." Only so long as the air contains this secret cause can the epidemic rage. Hence this "state of the air," which has been translated back to us from the Latin into "atmospheric constitution" means only the presence of the germs of disease. He further says* that the various epidemic states or constitutions of different years "owe their origin neither to heat, cold, dryness, nor moisture; but rather depend upon some unknown change from the very bowels of the earth, contaminating the air with such special effluvia as force the human body into this or that disease." Upon the conveyance of such infecting germs from the sick to the healthy, the extension of every epidemic depends; details of the successive infection of each individual would be the full history of the epidemic. The prevention of disease requires us to know the conditions under which the different infections act.

It is by careful study of each of the special poisons that a nearer approach is made to the successful investigation of epidemics. Emanations from scarlatina chiefly cling to everything they touch, and are restricted to small distances; those of whooping-cough and influenza can be widely diffused through the air. Much that is attributed to a remote or indefinite cause, such as season, will be found dependant upon some intermediate condition with which season, for instance, may have only an indirect connection. Low temperature, harmless in typhus, is prejudicial in measles, directly and indirectly. Measles is more common in winter and spring, because the bronchial mucous membrane is then more susceptible; the greater fatality of measles with us in cold weather is less an effect of temperature than of the tainted air pent up for the sake of warmth.

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* *Op. cit.*, p. 30. Observationes Medicæ circa Morborum Acutorum Historiam et Curationem. Authore Tho. Sydenham, Londini, 1885, cap. i. § 6; cap. ii, § 5.

Some of the epidemic poisons, notably that of yellow fever, have limitations of elevation and of temperature above and below which they cannot exist. Small-pox, increasing in winter, is replaced by cholera in summer; both may be very fatal at the same time and place, and are utterly distinct. Some others are modified greatly by temperature; little doubt can remain, after seeing how exactly the diarrhœa of our later summer months is replaced in the winter by cough and catarrh, and noticing how, by almost imperceptible gradations, they pass into each other, but that a similar poison is operative in both cases; or the alteration may be in the susceptibility, or the different balance of health of the individual attacked.

The epidemic constitution of any place or period, to use the phrase of Sydenham, not only comprehends the result of the preceding influences and takes into consideration the varying circumstances, social and physical, affecting the individual, but specially includes the full estimate of the extraneous elements of contagion existing around him. The phrase is rather the expression of the general state of the health of a locality prevailing at the time of observation than of a separate condition, and the existence of contagion is of the very essence of the idea to be conveyed. In this term are summed up the vestiges of an infection that is disappearing, and the first evidences of an invading disease is recorded; in the absence of all traces of contagious maladies it is sometimes said that "no epidemic constitution" prevails.

To bring about and perpetuate so desirable a condition, next to the supply of fresh air and pure water, and, indeed, one of the conditions for preserving the purity of these first requisites, it is of primary importance to reduce infection to its smallest possible limits. Not only must disinfection begin at the body of the sick, but it must commence with the first elimination of disease-germs, and be continued until they cease to be given off. This course is the way to the safety of the individual, the protection of those immediately surrounding, and the incalculable amelioration of the public health. For this we must know how soon infection begins, and how long it lasts; otherwise our efforts to check the spread of epidemic disease will often fail, even where our knowledge of the laws governing the course of the special infection is full enough to place it almost under our control.

How soon does infection begin? how long does it last? Of the two questions proposed, the former might be dismissed with an obvious answer as of little importance, while the importance of the latter is as clear as the difficulty of answering it is great; this difficulty may be simplified, and, it is hoped, be made to yield some rules of practical service before the conclusion of the paper. Practical considerations of no slight interest also depend upon the first part of the question, the answer to which is not quite so simple as it may seem, but in reality involves some intricate pathological problems, as well as hygienic deductions of the greatest importance.

Effective limitation of disease, in epidemics having a most marked influence on mortality, especially among the young, must greatly depend on the recognition of the fact that *infection begins as soon as the disease*, so that our first question is pushed back to " when does the disease begin?" If the answer be, upon the development of the more prominent or characteristic sign by which the disease is known, be it rash, whoop, cough, or diarrhœa (and this will always be the popular response), then, in order to meet the popular notions of disease with warning and direction that shall be generally useful and intelligible, we must let it be generally known and understood that infection is to be guarded against while a person is only sickening for diseases, such as small-pox, measles, mumps, hooping-cough, diarrhœa, cholera, and diphtheria, and be prepared to give authority to the somewhat startling announcement that " diseases are infectious before they are developed." The incubation period, as it is called, of epidemic diseases, affords us the means of translating this paradox into a scientific position; a correct and definite idea of the first steps, the ingress, of these diseases lies at the very root of this inquiry, and merits a full investigation.

The incubation period has been divided into the two distinct and separate stages of latency and invasion; a division admitted indeed and applied vaguely to the beginnings of these diseases, but not with that definite and scientific precision which is to be sought for in each special disease of the class, and which must be reached before such general conviction as is alone conducive to useful action can result. Excepting mere conveyance, diseases are not communicable by personal infection until they have themselves been received by the infecting person ; nor when received are they immediately communicable, unless certain local effects from contagia, coming before any general illness and even without being followed by any, may give rise to infection ; for it may be stated generally that an interval must elapse before infection received can be again propagated.

This period, of longer or shorter duration for different diseases, nearly without symptoms and probably non-infectious, is the stage of latency ; then, with the earliest symptoms, commences the stage of invasion. Febrile movement is now progressive and continuous, so that it cannot be stopped or averted ; the disease-germ multiplies, products of the diseased action are formed, and infection begins. This point is marked by elevation of temperature, easily recognised by the thermometer ; it is often preceded by an equally recognisable thermometric depression, analogous to the shock after injuries, marking the first effects of the poison.

Until now the attack might have aborted ; this is one mode of escape from the diseases we most frequently encounter. Abortive attacks afford no protection against the liability to a subsequent infection ; they sometimes procure a temporary immunity where a continuous exposure to an infection has reduced susceptibility ; more frequently some premonitory symptoms appear and disappear after a short or casual exposure. Some few diseases, at first local, where the early manifestations are under control, may be aborted by direct treatment. But it is a grave mistake to trust to local treatment in a general disease, Diphtheria, for instance ; it is an error to suppose scarlet-fever or measles can be lessened by emetics or aperients clearing away morbid matters ; no increase of the ordinary secretion of the body can eliminate the poison or germ of these diseases ; the more intense the disease the greater the specific product, and the greater the risk to all. The disease once set up is, from first to last, an elimination of itself *in its own form and manner ;* which self-elimination, the sign of the disease, is the very source of infection, and the basis of the axiom that infection begins as soon as the disease.

During incubation the latent period, nearly without symptoms and probably non-infectious, may either be absent or be prolonged within certain limits varying for each special disease; to ascertain these limits is necessary to an effective quarantine. The characteristic of this period is its variability, and it is to this that the wide divergence observed in the time of incubation of certain diseases is owing.

The period of invasion is more fixed, and nearly constant for each special disease; to recognise the commencement of this stage is necessary to the successful isolation of persons already affected by disease, so as to prevent its extension to others.

The incubation period, though divided in this way, may still be usefully spoken of as covering all the interval from the beginning of infection to the first symptoms of the disease. A fixed time can more readily be assigned to it as a whole, not without some of the uncertainty that still attaches to its essential divisions; for, what is spoken of as the stage of invasion in a particular disease by one writer, might by another be included in the course of the disease, or, more frequently, be overlooked or lost sight of in the period assigned to incubation.

This stage of invasion, then, differing in each different disease, but uniform within moderate and ascertainable limits for the same disease, is *the constant quantity* of the period of incubation, if reckoned as a part. It does not commence immediately or directly upon exposure to its exciting cause, and often at a surprisingly long, though at a remarkably uniform interval. The latent stage not only varies for each different disease, but according to the different modes by which the poison of each is conveyed into the blood, possibly also as to the amount and intensity of the poison introduced.

Direct inoculation of the virus of any special disease affords us an opportunity of observing with exactitude the time occupied from the initial processes to the fully developed disease; a slight difference even here is observable in the first stage, and a question arises as to how far the local multiplication of the inserted germ may go on before such general disturbance of the system is set up as enables us to say that the disease in question is produced. This process once largely practised in the inoculation of small-pox, the typical disease of the class, and everyday observable in vaccinia, furnishes us with the best analogue to what must take place in allied diseases; the result is a short period of latency and a definite stage of invasion, so that the incubation period necessarily occupies many days.

The same thing is observable in measles; though the exact time when the poison was introduced may be uncertain, it must be certain that it was received days before the full characters of the disease became obvious; for those days are necessary to the development of the initial processes of the disease, which here occupy four days.

It may be affirmed, therefore, of some diseases, that they cannot show themselves except after a certain interval, the stage of invasion, following upon the uncertain period of latency, and that consequently their incubation period must be a long one. On the other hand, without assuming that some diseases arise at once with full malignity, it is seen that the different processes by which their virulence is acquired may be gone through with extreme rapidity, and of these, it may be affirmed that the period of incubation may be short.

Small-pox, vaccina, measles, rubella, mumps, varicella, typhoid, typhus, and from one point of view, whooping-cough represent diseases having a long incubation period. Relapsing fever forms the connecting link with the division having a short incubation period, where we find besides scarlet fever, diphtheria, plague, cholera, yellow fever, diarrhœa, influenza, denguè, erysipelas, and, if strictly investigated, whooping-cough, which combines some of the leading features of both classes.

A long incubation period is generally followed by a very definite illness terminating in a crisis, and, excepting debility, with sequelæ neither very prolonged nor very definite; the infection ceasing at a comparatively early period of convalescence. A short incubation period commences a sudden morbid disturbance, having either a long or a short process, very liable to relapses, and to prolonged or definite sequelæ, infection persisting far into convalescence. It follows that infection is spread most at the end of these diseases, with a short incubation, generally from impatience of their last lingering effects; and at the earlier, or even the earliest part of those, with a long incubation period, from disregard of their premonitory symptoms.

The duration of this period for the more frequent diseases should be widely and generally known, so that instead of referring an attack of small-pox or measles to an imaginary fright, chill, or other circumstance of the day or two before, the true source may at once be sought in the occurrences that preceded the illness by exactly twelve days.

Exact data as to the origin of fifty cases of measles have been collected, showing to what extent the time of incubation may vary; many of these instances illustrate in a striking manner how constantly this disease is propagated before the rash appears, and consequently how hopeless is the effort to prevent its spread among those who have been in close contact up to the time of the eruption. On the other hand, where no such previous communication occurred an effective separation was maintained in cases 24 and 25, who were brought home at the height of the rash of measles, but kept apart from the other children of the family. Case 45 affords another instance of measles being communicable before the rash.

Of the forty cases of rubella now for the first time brought together, twenty-eight afford data for fixing the incubation period. This is found more frequently to exceed a fortnight than to fall far short of it; of the cases referred to (p. 174), two of them, cases 4 and 5, may have extended from ten days to twenty-one. Case 3 alone serves to fix the shortest limit at ten days; twenty cases have fourteen days as their shortest limit; in fifteen cases, the longest limit may have reached to sixteen or eighteen days; and, in three or four, this seems to have been twenty-one days, thus equalling mumps in the length of interval possible.

This disease, unlike measles, may recur, though rarely; as with measles and chicken-pox, it can probably be conveyed by fomites. A clear instance of mumps being thus conveyed has come under notice; a boy returning from school where mumps prevailed, his family take the disease three weeks after, while he escaped.

The youngest children are not exempt from these diseases. Small-pox has been gone through *in utero;* vaccination may be effectively performed on the day of birth. The rash of measles may appear as early as the third week after birth; in an infant born while three other children were ill with measles, the first symptoms were noticed a fortnight after birth, and the rash on the third day, the attack being less severe than it usually is in the first two years of infancy. The youngest infants often go through scarlet fever favourably. Whooping-cough may be fully developed in a child a fortnight old; at p. 184 is seen with what result.

Whooping-cough is brought into the first group more because of the frequency with which it is communicated in its early stages, than from any valid claim it may have to a long period of incubation. The stage of invasion is often considerably prolonged, nor need we dispute as to the right this stage has to be considered, in the absence of the whoop, an essential part of the disease itself, so long as we recognise that it is a serious and highly infectious part of it. The remarkable association of whooping-cough with measles also gives it a right to some notice here; statistics on a large scale show this connection to be the reality that partial observation has frequently remarked; a close parallelism is also observable in their ingress, so that sometimes a doubt may remain whether, in a particular instance of impending illness, the one or the other is to result.

Measles and whooping-cough exhibit a mutual interference during development, so that if contracted together the one or the other is delayed; a mutually intercepting influence is also noticed with regard to whooping-cough and varicella (p. 178); while with more nearly allied diseases it would seem that some of their initial stages, instead of intercepting each other, could be accomplished together. When a child has been exposed to the infection of both mumps and measles, the measles having the shorter incubation period is the first to appear, mumps showing itself about ten days after the subsidence of the measles, or in a time but slightly, if at all, in excess of that sometimes occupied in the development of mumps when there has been no intervening illness.

These diseases are frequently separated for us by a process of clinical analysis, and shown to be distinct, whatever be the degree of affinity between them. Where, as in cases 18 to 21, a child who has previously had whooping-cough takes the infection of measles from another suffering from the mixed complaint, the former communicates measles only to one who has never had whooping-cough; even those susceptible to whooping-cough, as cases 27, 28, may contract measles only, from one suffering from this complication, if a moderately careful separation be maintained after the termination of the eruptive disease. During the earlier part of the concurrence of mumps with measles, even where some symptoms indicative of mumps are already present, up to the completion of the eruptive process, measles alone is communicated to children susceptible of both; a child having received the infection in this way will propagate measles only. Persons who have previously had mumps, when exposed to the mixed complaint after, or at the time the mumps is most prominent, will take and give measles only. Where the exposure is the same, but the susceptibility reversed, mumps only will be communicated.

Infection, commencing at the very beginning of diseases of the first class, and probably most intense at their height, continues with great intensity during the earlier convalescence. In small-pox, measles, mumps, and varicella, for a fortnight after the eruption the greatest care is requisite to guard against their spread; but many instances point to the infection of these diseases of slow ingress disappearing in a comparatively short time afterwards, so that three weeks may often suffice to terminate the persistence of personal infection, this, in small-pox, corresponding to the disappearance of the last pustular crusts. No such limited time can be assigned to some diseases of the other class. Whooping-cough, contagious before its characteristic sign is developed, probably ceases to be infectious before all traces of spasmodic cough are lost; but scarlet fever continues to be infectious long after all remnants of local morbid action are removed, so that personal contagion may persist for nine or ten weeks from the commencement of an attack. The shortness of the incubation period, and the suddenness of ingress, in scarlet fever, diminishes the chances of its being unexpectedly conveyed, and enables its progress to be checked by a timely separation of the sick. The long incubation period of other diseases favour their unexpected dissemination. In one of them, measles, it would not be too much to say that one-half of all the cases met with are contracted during the premonitory or catarrhal stage.

To limit the extension of most infectious diseases it is necessary to recognise the first signs of ingress. A close parallelism is presented in the earlier stages of most of them; this can be well studied during the course of vaccination; by careful observation of the one we learn to appreciate the slighter symptoms of the others, nor till we recognise these shall we be able to stop the spread of many of the most fatal among them, for it is while sickening for small-pox, as well as measles, that infection commences. On this account the invasion of the more readily inoculable diseases should receive careful study.

In vaccination the earliest vesicle of vaccinia will reproduce the disease, while from vesicles of the sixth and seventh days it may be so certainly propagated that the smaller quantity of lymph then procurable is the chief obstacle to the practice. Inoculated small-pox corresponds to what is observed in vaccinia, with less tendency to variation from the greater intensity of the poison; it is only latent till the third day, then a papule appears, this on the fourth day si vesicular; there is local irritation on the fifth, glandular sympathy on the sixth, rigors and nausea on the seventh and eighth days; two days after, possibly four, the eruption shows itself. These two last days are identical with the two days sickening for small-pox, and they are infectious. With the secondary eruptions on the eleventh day, the inoculated pustule is at its worst, and on the fourteenth has a crust. At the end of the last century, when inoculation was the common practice, children were removed to a house provided for the purpose as soon as the sickness began, and before the eruption appeared, so as to prevent small-pox being set up in their own houses.

Vaccination and inoculated small-pox follow the same course until the ninth day, when the former terminates in the areola and sets up no diffusible infection Their shorter incubation period does not admit of either modifying in any way the course of small-pox already received by infection. We vaccinate any persons exposed to small-pox, and at once remove such for a few days from the source of infection, in the hope that they may not have already taken it, for happily all do not at once suffer from infections to which they are exposed. At one time it was thought that if we could vaccinate within four days of the exposure to small-pox, a protective effect would result. The last small-pox epidemic showed that the special nurses could not commence their duties with impunity until a re vaccination was seen to be effective.*

Small-pox is communicable from the moment the initiatory fever begins. It may be given by the breath of the patient before the eruption has appeared on the body.—MARSON.

Dr. T. Ridge-Jones in the *St. George's Hospital Reports* for 1872, pp. 235-40, gives a most instructive account of how the linen used by a small-pox patient propagated the disease in that hospital through the medium of the laundry on more than one occasion before the mode of conveyance was detected, and the further spread of the outbreak stopped. In all these occasions the cause was traced, by counting fourteen days backward from the eruption in the different cases, to the removal of linen from those suffering from an attack; its redistribution to the wards showed how, in ordinary washing, heat is seldom applied at a sufficient height, or for a sufficient time, to destroy infection. The original source of infection was a woman who had been out of the hospital (and so possibly exposed to contagion) exactly twelve days before she was taken ill, and fourteen before the rash.

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* A doubtful belief as to the protective power of inoculations over past infections, has lead to the late extension of rabic inoculation. M. Pasteur's inoculation of rabbits from rabid dogs has produced a form of disease with a shorter incubation than that of furious rabies; this again will protect a dog from future risk from a rabid bite; it has not yet been proved to be effective against infection already received.

These cases, however illustrative of the axiom that "the time from taking the disease to its appearance on the skin is never longer than fourteen days," do not afford precise data for its confirmation; our conviction is based more upon common experience, and the rarity of any valid instance to the contrary being brought to notice, than upon the recorded facts of cases that had originated from a definite source of infection where the limits of the exposure were accurately known: it would be satisfactory to receive the particulars of such cases from our small-pox hospitals; any illustration of variation thus collected would not be without both scientific interest and practical utility. Dr. Gregory* has published an instance of twenty-one days' incubation of small-pox from a definite exposure; for the short period of ten days very exact details are given of a young medical friend accompanying him to the Small-Pox Hospital on a Thursday; he soon after became languid, and his appetite fell off; on Saturday, in the ensuing week, rigors came on, and, two days afterwards, the eruption of small-pox." These two cases and seven others of small-pox from Dr. Gregory, present a striking analogy to what will presently be seen in measles.

We may conclude that small-pox begins in most cases twelve days after infection, and seven or eight days after inoculation; so that it would seem to be almost an impossibility for small-pox to appear in less than twelve days from exposure to infection, or in less than eight days after the reception of the virus in the most direct manner, the latter being the shortest time in which the disease can be developed, even when the period of latency is reduced to a minimum.

The infecting poison of small-pox so abundantly produced during the height of the disease, and of such intense activity then, does not seem to attach itself to the individual for long after the pustular incrustations clear off at the end of the third week, though the infection will cling to the clothes and furniture for a long time; it may lurk in some parts of the chamber for two years, as one case that came under my own observation seemed to show; how long it might be preserved in the dried crust is indefinite.

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* "An Essay on the Periods of Incubation of the various Morbific Germs:" addressed to the Central Board of Health, by George Gregory, M.D., Physician to the Small-Pox Hospital. The *Cholera Gazette*, Jan. 28th, 1832, No. ii., p. 60.

Small-pox also presents the typical example of what is seen in some other diseases, for instance, scarlet fever and whooping cough, viz.: that persons suffering from a second attack, however mild or however modified, may communicate the disease, in all its virulence, to others who are susceptible. A most significant illustration of this is given by Mr. Marson, in the case of a lady who, twelve days after meeting with a person infected with small-pox, has an illness, with delirium, but no eruption; a sister confined to the house with her, is taken ill twelve days afterwards, and has confluent small-pox. Something analogous happens sometimes in measles, when convulsions and lung complication have prevented the appearance of the rash, yet infection is propagated; in such a case protective effect is produced if the patient recovers.

Measles has a shorter time of incubation than small-pox: the rash will never appear until a week after infection, it will often be deferred until a fortnight; the usual interval is ten to twelve days. Measles has been inoculated, when the interval was seven days; now the initial processes of the disease occupy five or six days, of which the last four constitute the well-known catarrhal stage of measles, so that we have here but three days of incubation, even if we include the initial fever, which terminates the incubation stage. This period of incubation is prolonged for a day or two, not without symptoms, when the disease is taken by infection, and then from two to four days of latency must often be added, so that a child cannot be said to be free from the fear of taking measles, and consequently of giving it to others, for a fortnight after being exposed to infection. The longest interval met with from exposure to the full rash has been eighteen days.

The first of the following cases, affords the shortest interval from infection of measles.

Case I.—A girl, 12 years old, who had been away from her family since Christmas (certainly for three weeks), is brought home on January 24th, 1865, when her next sister and a younger brother are both ill with the measles and have the rash upon them; two days after her return this girl has headache and the initial feverish disturbance with quickened pulse on the 27th, catarrhal symptoms on the 28th, the full rash on the 31st; seven days only after coming to the infected house.

Case 2.—A girl, aged 11 years, sister to the above, was slightly febrile on January 17th, she attended an evening party on the 18th, had coryza on the 19th, rash on the 22nd; the illness was at its height on the 23rd and 24th, with serious short complication; time uncertain.

Case 3.—A boy, aged 7, constantly with his sister, Case 2, is not noticeably ill till the 22nd, with rash on the 24th, at its acme on the 25th; time uncertain.

Case 4.—A girl, aged 9, sister to the above, at home throughout the illness of the others and frequently in the sick room; slightly febrile on January 27th, pulse not quickened till the 29th, full rash on Feb. 1st; eight to ten days for incubation.

So that this child, Case 4, who was with the others throughout the illness, does not take it so rapidly as her elder sister, who is brought fresh into the infection when at its height. Cases 2 and 3 probably contracted the disease at the same time from an unknown source of contagion.

Case 5.—A boy, aged 7½ years, attends a school daily when on Oct. 24th, 1868, a boarder is complaining of illness which is known to be measles on the 26th. The boy, Case 5, was not at school on the 25th and 26th; he went for his books only on the 27th and then stayed away; on the 31st he vomits, seems pretty well next day, but is ailing on November 2nd, and has the full rash on the 6th; consequently an interval of six days before any symptoms, and of twelve to the rash; incubation period eight to ten days.

Case 6.—A brother, aged 5 years, with exactly the same exposure on October 24th, had the initial fever on November 2nd, high fever on the 6th, full rash on the 7th and 8th; incubation period ten to twelve days.

Case 7.—A girl, aged 6 years, sister of these last two boys, was removed from the house in which they were nursed on November 5th, and was not in the room with her brothers after November 4th. She has the rash on November 15th and 16th, or, after twelve days.

Case 8.—A boy, aged 1¾ years, brother of the above, removed on the same day as his sister, November 5th, and slept in the same room with her, is not noticed to have any symptoms of illness till November 15th, when the pulse was 116 and the temperature 99 degs. at night. He has the rash with convulsions on the 18th; this is on the fourteenth day after separation.

Case 10.—A boy, aged 12 years, leaves school, where cases both of mumps and measles had recently occurred, for the Easter holidays on March 20th, 1869, and goes to Brighton. He seemed dull on the 27th, returns home on the 29th, and has the rash of measles on the 30th, on which day by noon he is removed to another house; ten to twelve days for the incubation of measles; in another ten days after this he had mumps.

Case 11.—A boy, aged 6½ years, who was with the last case from March 26th to the 29th, and is watched rather closely lest he should have the measles, has the initial fever on the night of April the 4th, and, after a slight subsidence, the usual symptoms on the 7th and 8th, with full rash on the 9th and 10th; again ten or twelve days from greatest exposure.

Case 12.—A girl, aged 5 years, sister of the above, is one of three children whose chief exposure to infection arose from the boy, case 10, having spent one night in their house while throwing out the rash of measles, March 29th to 30th; she has premonitory symptoms on April 4th, some cough came before that, and the not unusual temporary lull in the symptoms on the two following days of incubation, coryza on April 8th, and the full rash on the 11th and 12th ; ten to twelve days' interval.

CASE 13.—A boy, aged 4 years, brother to the above, exposure the same, has cough on April 9th, and the full rash on the 13th ; twelve days' interval.

None of these children took mumps on this occasion, though the boy from school, who brought measles into the house, had also received the infection of mumps and spread the infection of it ten days afterwards. Case 1 of mumps.—The eldest boy in this family was much with him during the incubation, but not after the eruption of measles. They all (Cases 6 to 12 of mumps) passed through that ailment in the following year, shewing that they were at this time susceptible.

CASE 14.—A younger sister in the above family, at first not much with the other children sleeps with them on the nights of April 9th and 10th ; she begins to cough on the 22nd, and has the rash of measles on the 24th and 25th ; interval twelve to fourteen days.

CASE 15.—A girl, aged 6 years, until May 10th much with a companion who a few days after is ill with measles, complains of fatigue on the 15th, and from that time remains at home ; she becomes febrile on the 19th, with sore throat, fulness of the gland at the angle of the jaw, stiff neck ; next day there is less fever, but the glandulæ concatenatæ are enlarged ; there is cough on the 21st and 22nd, coryza on the 23rd, with less cough, and the first signs of the rash. This is fullest on the 25th ; on the 26th there are severe pulmonary symptoms, relieved by stimulants, but persistent with complete defervescence on the 27th ; nine days' interval, or thirteen to the more marked signs.

CASE 16.—A girl, aged 4 years, is taken to see a brother who is ill at another part of London, on February 19th, 1872. She only stays half an hour, as her brother is found to have measles with the rash fully out. On March 1st, ten days afterwards, for it is leap year, the little girl sneezes ; on the 2nd she has headache, and feels ill ; is quite ill on the 3rd, and has the full rash of measles on March 4th ; fourteen days afterwards.

CASE 17.—A boy, aged 8 years, brother of the above, exactly the same exposure, does not complain of illness until March 4th ; next day he seemed better till evening, when spots of measles were perceived ; on the 6th and 7th the rash was full ; here a whole fortnight intervened, or sixteen days from exposure till the rash.

The following cases not only illustrate how measles is propagated during its catarrhal stage, but how a sort of clinical analysis is often performed for us, separating whooping cough from measles, just as in other cases we find mumps separated from measles.

CASE 18.—A girl, aged 6 years, ceases to attend school on November 25th, 1871, because she seemed ailing. On November 28th or 29th she begins to have a cough, suspiciously like whooping-cough. On December 4th, she has the first sign of measles, and the full rash on the 6th and 7th ; twelve days after her last attendance at school. The subsequent course of her illness makes it probable that she contracted whooping-cough at the same time.

CASE 19.—A girl, aged 6 years, visited the above girl on Sunday, Dec. 3rd, 1871, the cough was then the only symptom, and no signs of measles were visible till the next day, after which no communication was continued between the two houses, as the children of this family, though they had had whooping-cough, had not had measles. On December 14th she was seriously ill, but had not the full rash of measles till December 17th or 18th, fourteen to fifteen days' after. Ten days' incubation.

CASE 20.—A boy, aged 4 years, brother of the above, exposure the same, had rash of measles on December 14th and 15th, twelve days from exposure; neither of these children had any subsequent cough.

CASE 21.—A boy aged 1 year, who had been kept indoors with these children for two or three weeks, after a day or two's illness, has the rash of measles on December 26th and 27th, ten days after his brother and sister. This child, not having had whooping-cough, has no subsequent cough.

The next case presents a very clear example of measles being infectious during the earlier stages of invasion, and before the rash appears.

CASE 22.—A girl, aged 10 years, coughs and is febrile on February 20th; she has coryza and epistaxis on the 23rd, with the rash of measles on the 24th, attaining its height on the 25th, and subsiding, with complete defervescence, on the following day. A little boy had come on a visit to the girl's home on February 5th; these children occupied the same room at night from the 9th to the 12th; the boy is first noticed to be ailing on the 13th, and returns at once to his own home; he has signs of measles on the 15th, and the full rash on the 16th and 17th. He must have communicated the disease to the girl two or three days before himself throwing out the eruption. The interval from his leaving to the height of the girl's attack of measles is twelve days; had they not been separated on February 12th the interval from rash to rash would have been set down as eight days only.

The highly infectious nature of the catarrhal stage of measles is doubtless the cause of this disease so frequently spreading through schools and families. With every desire to prevent extension of the disease the separation is effected too late; the next case is an instance of this.

CASE 23.—On March 2nd, 1868, a boy at a day school is confined to his class-room because he was dull at his lessons; next day he is too ill to come at all, and the day after has measles. On March 12th, several boys who met in this class-room were away from school ill; they had the rash of measles from the 14th to the 16th of March.

On the other hand, where children have been kept apart during the earlier stages of measles, the limitation of the infection is possible, even where, as in the next cases, it is brought into a dwelling at its acme. Here personal infection seems to have ceased in three weeks.

CASES 24 and 25.—Two girls of 14 and 11 years old, are sent to school, January 13th, 1872; they have coryza on the 27th, and are brought home with the rash of measles fully out on the 30th. There are five younger children in the family, three of whom remain at home from the time the sisters arrive, the other two being sent away that a fair quarantine may be established; none of these children take the disease, and three weeks after it is over they mix freely with their convalescent sisters.

Instances of infection from a short exposure, both the limits of which are known, can never be so numerous as those from a longer exposure of uncertain duration; nor are they of such crucial value in determining the period of incubation as might have been expected, the rule being that the interval is longer after a single definite exposure of short duration, than where the exposure has been more continuous. The example of shortest interval (Case 1) resulted from a continuous exposure, the earliest limit of which was fixed. The instance of longest interval, presented by a case where the latter limit only of a continuous exposure is known, is the following:—

CASE 26.—A boy aged 6 years, one of a family of three children, attends a day school until November 17th, 1871, when he is removed from fear of measles and whooping cough, both prevailing among the scholars. He remains at home for some days as he seems to require rest; there is no other family in the house and no visitors. On November 26th he walks to the park, a very short distance, and is obliged to return he is so soon tired; next day he seems rather better, but is chilly on the 28th; he coughs and is sick on the 29th, and continues ill with fever and loss of appetite till December 4th, when he is delirious at night; next day he has the first signs of measles, and the full rash on the 6th and 7th. The time of incubation was twelve days, the interval from exposure to the rash was eighteen days, but there was reason to suspect a complication with whooping cough.

CASE 27.—A boy, aged 4 years, brother of the last and much with him until December 4th, sickens on the 10th, and has the rash of measles on the 14th, but does not take whooping cough.

CASE 28.—An infant, aged 8 months, of this family, not much with the other children, also sickens on the 10th, and has the rash on December 14th.

The two younger children have whooping cough two years afterwards, when the elder boy escapes.

CASE 29.—A boy aged 6 years, at a large day school, where are both measles and whooping cough, is feverish on the night of March 26th, 1872, and remains at home; he coughs on the 28th, and has the rash of measles on March 31st.

CASE 30.—A boy, aged 4½ years, not at school, brother of the last and with him from March 26th, has the rash of measles on April 7th, with rapid defervescence on the 8th, and no subsequent cough; probably having taken the infection of measles from his brother while he was sickening. The elder boy was seriously ill for the four days preceding the rash, with delirium and convulsive dyspnœa: again, after the rash, he was dangerously ill with extreme dyspnœa and spasmodic suffocative cough until 12th, with clubbing of the fingers and dusky face and lips; the lung complication not being proportionate to the distress suffered. On recovery at the end of the month, the finger ends became flattened at the sides, and the nails for a time arched. This boy had previously had whooping cough. His father suffers from asthma.

The following cases were complicated with subsequent whooping cough.

CASE 31.—A boy, aged 6 years nearly, the eldest of four children in a poor family, commences, by school-board authority, to attend day school on March 11th, 1872; several children in his class have coughs; he begins to cough about ten days afterwards, and had slight symptoms of cold, but continued his attendance at school up to March 28th, when the cough, already spasmodic, almost amounted to a whoop. He was quite ill on March 31st, and had the full rash of measles on April 2nd and 3rd; he was rather slow in recovering his appetite and strength, but seemed pretty well on April 20th, soon after which his cough became more noticeably spasmodic, and he suffered the extreme effects of whooping-cough, from which he died on June 2nd.

CASE 32.—A girl, aged 5 years, sister of the above, at the same school, in a different class, discontinued attendance at school on March 28th, when she has coryza, but less cough than her brother; on April 2nd she appeared lively and well, but had a quickened pulse and a temperature of 102½ degs.; this exceeded 103 degs. by morning, and was more than 104 degs. in the evening, exactly 104 degs. next morning, April 4th, by evening it slightly diminished as the rash of measles appeared. There was a full rash on the 5th and 6th, with complete defervescence on the 7th.

CASE 33.—A girl, aged 3 years, another sister, has the first febrile disturbance, and some redness of the conjunctiva, on April 5th, with slight subsidence on the 7th and 8th, coryza on the 9th and 10th, full rash on the 11th, and defervescence on the 12th. This child probably took the infection from the others between March 28th and April 2nd.

An infant in this family, a boy, has slight cough, with sickness, on the 5th of April, disappearing after two or three days without rash. He begins with whooping cough on the 4th of May. The two girls showed the first symptoms of whooping cough on April 28th, a week later than the elder brother. Supposing that the elder boy took the infection of whooping cough with that of measles, at school, and that his elder sister did not, which seems to be the necessary conclusion to be drawn, an illustration is afforded of how a certain proximity is necessary to the conveyance of infection; it is probable that effective ventilation, both in bed-rooms and schools, would limit in a great measure, if it did not prevent, the spread of this disease.

The order of infection with whooping cough shows it to be no necessary consequence of measles appearing at a definite time afterwards, for here two girls take the whooping cough together, while the one child had measles a week later than the other. Both these inferences are supported by the following cases:—

CASE 34.—A girl, aged 3 years, supposed exposure to infection December 24th, is ill on January 5th, 1872, and has the full rash of measles on the 6th. She begins with whooping-cough on February 3rd.

CASES 35 and 36.—Two girls, aged 5 and 4 years, sisters of the above, became ill January 13th, and have the rash of measles on the 15th and 16th, followed by some spasmodic cough. They have whooping-cough, the elder in March, the younger in May.

The order in which they were exposed to infection requires to be further noticed here. The youngest girl, the first to begin with measles, seemed to be making a good recovery, when on February 2nd she was taken on to the roof of the house, where there was a garden (the first and only time of her going out during her convalescence); next day she had a more marked cough, and again became febrile, with well-marked symptoms of whooping cough of some severity, from the 6th to the 19th of February. During this time the little girl was nursed apart in her mother's room; on the birth of a baby she had to go to another room, at first with the nurse and afterwards with the elder sister; this sister has whooping cough in March. The little girl again goes to sleep at night in her mother's room in April, and before the end of the month the infant, now two months old, gets the cough. The other girl, aged four years, who had been more alone, and slept in a separate room, does not take whooping cough until May 4th, has high febrile disturbance all the month of May, and dies with symptoms of cerebral disease in the middle of June: so that the whooping cough was contracted the one from the other, and had no definite relation to the measles; for the infant, who had not measles, took it sooner than the little girl who, having had that complaint, was kept longer separate from the others.

This part of the subject will be concluded with cases of uncomplicated measles in two other families, and two instances of supposed second attacks.

CASE 37.—A boy, aged 10 years, at home from school for the Christmas holidays sickens for measles on January 17th and has the full rash on 21st. A younger brother sickens on the 26th and has the rash of measles on the 30th, ten to twelve days after exposure.

CASES 38 and 39.—Two girls, aged 8 and 4 years, sisters of the above, show symptoms of measles on the 27th, and have the rash on the 31st of January, ten to thirteen days after exposure.

CASES 40 to 44.—A boy, aged 7 years, second child in a family of four, was noticed to be ill on July 18th, has coryza on the 20th, and the full rash of measles on the 22nd. An elder sister sickens on August 2nd and has the rash of measles on the 6th. Two younger children, ill on August 4th and 5th, have the rash on the 8th or 9th. The mother, who was in constant attendance upon the children, but had had measles herself when eight years old, felt sick and giddy, with aching of limbs at night on August 9th, seemed ill as with a cold from the 10th to 12th, and, on the morning of the 11th, found herself covered with rash; this began to fade by night, leaving some irritation of skin, and a feeling of weakness, but no further illness.

CASE 45.—A young man, aged 23 years, had measles fifteen years ago, he felt giddy on the evening of February 27th; next day he was ill with signs of catarrh, there is rash at night with cough, and every characteristic of measles. On tracing back fourteen days, it was found that he passed the night of February 14th shut up in a close cabin in crossing from Liverpool to Dublin; he returned on deck, and thought he had taken cold in his journey home, where he had but just arrived in time to take to his bed on the evening of the 28th. The account of the previous attack is from family memoranda written at the time and points to that having been rubella. This case affords another instance of measles being communicable before the rash; measles appeared a fortnight afterwards in the family of a friend who was with this gentleman on February 27th. The previous attack proved to have been one of rubella; so that in no case has the rash of second measles come under my notice.

The invasion stage of measles may be so brief as to escape notice; this will seldom happen in more than one of several children affected at the same time, so that all doubt as to the true nature of the disease soon vanishes. The following three cases bearing upon this point occurred in the family of a most accurately observant medical friend.

CASE 46.—A florid healthy girl, aged 6 years, has the rash of measles on February 4th, with no obvious evidence of previous sickness, not even for an hour; there are two other children at home with her who have not hitherto been segregated by day. On looking back a fortnight it was found that these children, a sister one year older and a brother one year younger than this little girl, all carefully withheld from Christmas parties, had been taken to the pantomime on January 21st and to a circus on the 20th. It soon became evident that, with the same exposure, the sister and brother had not taken the infection at that time; they were now carefully watched. The elder girl has headache on February 12th, at night the temperature is high, next day this is normal, but is raised on the night of the following day to 101 degs.; it continues to be high for the next two days with cough; the rash appears on the evening of the 15th, and is full on the 17th, defervescence is sudden and complete on the 18th. The little boy is placed under observation at the same time. A slight elevation of temperature is found on the night of February 12th, next day there is cough; some spots of measles appear at noon on the 15th, and there is copious rash with temperature of 103 degs. at night; on the 16th the rash and all the symptoms are very intense; on the 17th the temperature is reduced to 99½ degs. in the morning after diarrhœa, in the evening it is raised to 102½, with a trace of bronchitis; next day this disappears, and the defervescence is complete: the interval for these cases is eight to twelve days.

The two succeeding cases have some features both of resemblance and of contrast to the last; they show that a long interval may be looked for after a limited exposure, and that a continuous exposure tends to shorten the interval.

CASES 49 and 50.—Of two little girls, the youngest, aged 4½ years, has the rash of measles on Saturday, March 8th; she had been ailing all the week, and had seemed dull and easily tired in the preceding week; she had been with her sister to a morning performance at a circus much frequented by children on February 22nd. The elder girl, aged 10 years, when seen at noon on March 8th seemed to be quite well except for a slight excitability of manner, a quick pulse of 100, and an elevation of temperature to 99½ under the tongue—this, probably normal for midday, at night was 98 degs. only. Next day both pulse and temperature were normal. It was evident that this child had not taken the infection with her sister at the circus. She had slept in the room with her sister during the two nights of fever, and, besides having been with her much during the few preceding days, was now entirely confined to the same room; she was without any sign of illness on March 10th and 11th; on the 12th she was lively, but again had a slight rise of pulse and temperature; on the 13th she was sick in the morning; next day the pulse was 116, the temperature 101 degs.; her appetite continued good until the 16th, when the temperature rose to 102.5 degs. and the spots appeared in the evening; on the 17th there was full rash after a temperature of 103.9 degs. had been reached; next day there was the usual subsidence of temperature, with complete defervescence on the following day.

From the care those children always receive, from the limited number of their visitors, from the fact that the elder only of the two goes to school, and that the younger is always with her mother, who even takes her for her walks, no doubt remains as to other sources of infection; tracing back a fortnight from the appearance of the rash of measles brings us to this visit to the circus, the one amusement with which these children had been indulged. An illustration of what is noticeable in the previous cases and must frequently happen, is seen in only one of these children taking the disease, though they both had the same or nearly the same exposure; fortunately, many risks of this kind are escaped. How soon the symptoms developed by the younger child could have imparted infection to the elder is uncertain; allowing four days for the period of infection before the rash appears as the limit, then, in the second case, the rash came on the twelfth day, but as the exposure was much greater at the height of the rash, namely, on March 8th, and the two subsequent days, it is more probable that in this second case eight days only sufficed to develop the disease, and of these it is clear that the first four days were without signs of illness.

Guided by the law that a short limited exposure to the infection of measles is followed by a longer interval before the disease appears than when the exposure has been continuous we infer that, when the disease is of unknown origin, by looking back a fortnight the illness can be traced to its source, but that where there is free communication with those already ill, the malady will probably be developed in less than a fortnight, and not sooner than the eighth day from the commencement of the exposure. The next cases are confirmatory of these inferences; the first two have ten days for the incubation period, the last case only eight days.

CASES 51 and 52.—Two children, a girl and a boy, aged 6 years and 4 years respectively, who, with one exception, had certainly not met, or mixed with, or spoken to, any other children, are seized with measles on March 25th, and have the full rash of measles on the 26th; they had some catarrhal symptoms for two or three days, attributed to change of weather. On inquiry as to the events of the previous fortnight, it appeared that these children were taken to a friend's house in London to see the processional entry of the Duchess of Edinburgh on March 12th; a person had been ill with measles in this house a fortnight before, and two days after, some children resident in the house, who were in close communication with these two during the two or three hours of their stay, became seriously ill with this prevalent complaint. A half-sister, aged 18 years, comes home to the house where the two younger children are convalescent, on Wednesday, April 1st, associating freely with them during the day; she sickens, and is chilly, with loss of appetite on the evening of Wednesday the 8th; feels ill the next day; has some spots of measles on the 10th, but does not keep her bed till the 11th; the rash was at its height on the 12th.

The duration of personal infection after measles is probably limited to three weeks from the time of the eruption. Infection is evidently as intense in the first week of convalescence as at any part of the illness, it is likely to be considerable in the second, and may persist into the third week. How completely this danger is over in the fourth week is shown by cases 24 and 25, where they not only mixed closely with young and susceptible children of their own family, but were also taken among others to a large establishment on the Day of Thanksgiving at St. Paul's, without being the cause of illness. The following case gives a further reason for believing infection to be over by the end of the third week.

CASE 54.—A boy, aged 9 years, son of a clergyman in the country; while at school sickens for measles on Sunday, December 7th, 1873. He remains away from home at Christmas, as his eight brothers and sisters, four older and four younger than himself, who have none of them had measles, are all at home for the holidays. On December 30th, exactly three weeks from the height of the rash, he returns to his family, mixing with the other children freely all day. He has a separate bed-room; his clothes were efficiently exposed to the fumes of burning sulphur, and he himself had a wash with carbolic soap; no one took infection from him.

This rapid disappearance of bodily infection closely agrees with what is observed of small-pox, and contrasts remarkedly with what will afterwards be noticed of scarlatina.

After exposure to the infection of measles the signs of illness cannot be expected to appear in less than a week, nor will more than a fortnight elapse before symptoms sufficiently indicative of impending danger give notice that the suspected person must not yet be allowed to mix with the susceptible. Only in those cases complicated with whooping cough, when the general symptoms were unusually severe, did the kind of illness remain in doubt for more than fourteen days. In the one uncomplicated case that exceeded this limit signs of the disease on the fourteenth day, sufficient to give warning of the impending eruption, were apparent; so that a fortnight's quarantine after exposure to measles will suffice to prevent unexpected outbreaks. In scarlet fever even a shorter quarantine might suffice, for the rule for measles may almost be reversed in this case, and we may say that if the disease does not show itself in the first week, or by the eighth day after exposure to infection, it probably will be escaped altogether.

Fifty of the cases of measles afford more or less accurate data for fixing the incubation period; the disease appeared in less than eight days in one case, in from eight to ten days in fifteen cases, in twelve cases exactly in ten days, in from eight to twelve days in fifteen cases, after twelve days in three cases; only one of those (case 17), extended to fourteen days; the incubation being reckoned, as it should be, from exposure to onset. In the essay of Dr. Gregory one case only of measles is referred to, where, after a single exposure, the full period of incubation is given as fourteen days; this being reckoned to the appearance of the rash includes two or three days of invasion, and may correspond to a true incubation period of ten or twelve days. No clear instance of a second attack of measles has come under notice; most of the so-called cases of second measles are attributable to rubella (*rötheln*, or *rubeola notha* of Babington), the rash of which, besides having some features distinct from measles, occurs without the precedent four days of catarrhal illness.

Rubella, rosalia, or epidemic roseola, has an incubation period of from ten to fourteen days or more, closely approximating therefore to true measles, *morbilli*, from which it is really distinct. That it is not second measles is well illustrated in the Cases 34, 35, and 36 of measles. At Christmas, 1869, these children had not had measles, when two elder sisters, who had had measles in the previous year, have this rash, and communicate it to them; they have it in as characteristic a manner as the elder girls, but without seeming to be at all more ill with it. Two years afterwards those younger girls go through measles without any modification.

Case 1.—The eldest of these girls was a weekly boarder at a school where a companion had a rash, supposed to be measles, on November 16th, 1869, and was sent home the same day, returning to school on the 22nd, sooner than was thought prudent by the friends of Case 1, as she had not had measles. To avoid infection, my patient does not return to school after this date, November 22nd. On November 28th she had some cough and seemed ill; but woke up lively and well on the morning of the 29th covered with this rose rash, finer, brighter in colour, less raised than measles, less diffused than scarlet fever, showing clear skin between the spots; she keeps her bed for two days, and gets up quite well on December 1st. During this interval the mother of her school friend visited her and said the rash and illness, or rather the absence of illness, seemed to be exactly as in her own child's case. Case 2: Her next sister sleeps in the same room and lies near to her; she feels heavy and amiss on December 13th; by evening she has the rash, and goes to bed earlier than usual that evening, but not until she had spent two or three hours with two cousins who had come on an afternoon visit. Case 3: The elder of the cousins became ill on Dec. 24th (on which day she kept in bed) with rash on the chest and arms in the morning; by evening this extended to the legs, body, and face, where it was very conspicuous next day, though she herself felt pretty well again. Case 4: The younger, sleeping in the same room with the last case, felt sore throat on January 3rd, and had the rash on the 4th, just ten days after her sister was in bed with it.

To return to the first family: the youngest of those who had previously had measles, slept in the same room with the two elder sisters, but at a little distance from them; she (Case 5) became ill on December 22nd, and had the rash on the 23rd, also ten days after the second sister's illness. These girls mix freely during the day with the three younger sisters, who sleep in a different part of the house, and who have not had measles; each one of these, Cases 6-8, has the rash early in January, or after another interval of ten or twelve days, without seeming to be at all more ill with it than those who had previously had measles. Three years afterwards these same children take measles, and the elder girls do not.

CASES 9 and 10.—A girl, aged 8 years, attending a day school, is very lively and well on June 5th, wakes up next morning covered with crimson spots; some remain sparsely distributed over the arms and legs on the 7th, but she is otherwise quite well. A younger sister, sleeping with her, complains of her throat on the 14th, but soon seems well again; they attend school together for a few days, and on the 22nd the second girl is noticed to have rose spots on her face in the afternoon; small, isolated, slightly raised, and not very bright spots occur on the chest and back at night. Next day the spots on the face form rose-coloured patches, not crescentic; isolated, slightly-raised pink spots occur on the arms, fewer on the legs, and very few on the feet.

These two cases are of interest as neither of these children had had measles. About three months afterwards an elder brother, aged thirteen, Case 11, who had measles some two years before, was sent home from school covered with a rash which, with apparent reason, was considered to be measles, for the eruption was very abundant, deep in colour, with very little clear skin between the spots, an elevation of temperature to 102°, and that disagreeable odour, on entering the room before ventilation had been seen to, which is so often noticeable in that disease. Neither of the sisters took any illness, though they were frequently in attendance on their brother, nor did three younger children who were kept more apart.

In a family of four children (two boys, aged nine and eight years, and two girls, of seven and five), the elder of the two girls, while absent from home, has rubella; the others escape. Next year they all have measles, this girl equally with the others. Early in the following year the brothers return from a preparatory school with rubella, and now the elder girl escapes, but the younger one takes it the week after the boys returned, and has sore throat and considerable hoarseness of voice.

Cases 16 to 21.—A boy at home for the Easter holidays, complains on April 2nd, 1869, of being tired, and next day has rash; he was secluded for two days, and then, on April 4th and afterwards, joined his family, seeing much of two elder sisters near his own age. On April 18th both those girls had the rash after complaining of giddiness and of feeling tired the night before the eruption. One of them had left home on the 15th, and communicated the complaint to two cousins who had previously had measles. A younger sister, not quite three years old, who associated less with the elder children, had well-marked rash on the 20th, with but little coryza and less marked symptoms of illness than the others, though they had had measles, and she had not.

Cases 22-28.—In these cases rubella occurred subsequently to measles. They are cases 46-48 of measles (*vide* p. 171). In this family an elder sister, who was not ill with these children, having previously had measles, comes home from school on May 7th with the rash of rubella, some fulness of the cervical glands, but no elevation of temperature. On May 26th, the under nurse and little girl (case 46) have the rash, on May 28th the little boy; he had looked pale for several days, but except debility and some fulness of the lips and tonsils, had no illness or fever after the rash appeared. On June 11th, case 47, the other girl has the rash; exactly a fortnight after the last case. On June 14th and 16th other cases occurred in this family.

The time of incubation can only be fixed in five of this series of nine cases, because the exposure was continuous. In this latter group from eighteen to twenty days occur before the first spread, and fourteen to nineteen to the second; in the former, one of the girls leaves home ten days after the brother joins them. Had she been separated from that time, before visiting her cousins, she, in all probability, would not have carried infection to them, though less than a fortnight's quarantine would have been as uncertain against this disease as it is in preventing the communication of measles.

Case 29.—A young man, W. F., aged eighteen years, in business in the city (source of infection unknown), while training for athletics, becomes easily tired in the evening of May 6th; next day he is better, but has headache and sickness the day after, the 8th. On the 10th he faints during a foot race, but is able to resume his duties on the 12th, and continues at the office until the 17th. The rash appears on the 18th; he has a week's rest at home; he returns to his duties on the 26th. On the evening of the 31st one of the clerks in the same office complains of fatigue, and next day has the rash. Another clerk, quite well on June 3rd, has the rash on the 4th.

There may have been some common source of infection for these cases, otherwise the two clerks may either have taken infection from W. F. on his return to them, if the incubation period can be as little as from five to seven days, or, as seems more probable, they took infection from him on May 17th, before the appearance of the rash, with an incubation period of from fourteen to seventeen days. In the next case there is no such uncertainty.

Case 31. A sister by marriage, in the same house, but not much with W. F. till the latter part of the week that he remained at home, removes to another part of London the week after, May 31st, and has the rash on June 8th. She felt tired only the day before, but on the appearance of the eruption, there was neither acceleration of pulse nor rise of temperature; nor was this the first time of her having a rash, believed to be identical, she having previously gone through both scarlet fever and measles.

Cases 32 to 38.—At a ladies' school of the highest class, with thirty boarders, a few girls from the neighbourhood are admitted to some of the classes; on Monday, March 30th, a day pupil was noticed about noon to have some spots on her face and went home; next day she was excused attendance because of a rash, nor did she return. On April 12th, one girl shows similar spots on the face; this was not thought much of until the next day, Monday, the 13th, exactly a fortnight after the day pupil left. Two other girls have also spots on the face, and the one first to show this has a decided eruption; two of these girls had slight headache with some tenderness of throat, and of some small glands on each side of the neck—one had no previous symptom. On each of the three following days one fresh case occurs, some having had similar sensations to the first two cases, also dating from Sunday the 12th; none of these had either coryza or cough; all these six girls had had measles from two to twelve years previously; in none was there any feeling of illness after the appearance of the rash. The longest period of incubation was here seventeen days. Some of the girls were sent home and a longer interval occurred in one other case. Those who took the complaint were not specially in contact with the original case, and in only one could any predisponent variation of health be traced.

In most of these cases of rubeola an incubation period of from ten to fourteen or more days is observable; the mean is higher than for measles, as the short period of ten or twelve days was only found in five cases; in fifteen cases this period extended to sixteen or eighteen days, and in three of them to twenty or twenty-one days. The period of invasion occupies one or two days only; infection is greatest at this time and in the two or three following days, it soon subsides and may be over in a week. Enlargement of the small cervical glands was noticed by Dr. Maton as an early sign in this disease—another point in which it resembles measles in its development; yet it was differentiated from that exanthem sooner that it has been from scarlet fever. The preceding cases show how small is the claim rubella has to be considered as second measles; this is as baseless as that of varicella to be looked upon as second smallpox. Both are distinguished from their more formidable congeners by the short ingress of the slighter exanthems; their evolution from the severer forms of disease is conjectural (see p. 171), but the nearness of their relationship is well expressed by the names of variola and varicella, and of rubeola and rubella. The incubation stage of rubella may be as short as that of measles; the *Practitioner* for September, 1887, p. 196, gives an instance of eight days only; that of five days is doubtful.

The two other diseases now to be noticed of the first group, varicella and mumps, correspond with measles in never appearing till after a week's interval. Infection in the latter may persist as in measles for three weeks; it probably ceases much sooner in varicella.

Varicella, or chicken-pox has an incubation period of rather less duration, subject to the same variations as measles. The following ten cases give an interval of from ten to twelve days for incubation. This was prolonged to fifteen days in Case 5, where the infection was from a limited and not very certain source, and to sixteen days in one of the three supplementary cases, which were complicated with whooping cough.

CASE 1.—A girl, aged seven years, who attends a day school, is noticed to have a spot on the lip on May 30th, and next day other spots recognised as those of varicella; she remains at home, is febrile at night, with full eruption next day; the height of the disease was on June 1st and 2nd when she remained in bed.

CASE 2.—A younger brother of the above, occupying the same bedroom, is ill with chicken-pox on June 12th; ten days after his sister's illness was at its height.

CASES 3 and 4.—Two elder brothers of the above have the disease on June 13th. The interval in these cases was probably twelve days.

CASE 5.—A girl, aged three years nearly, is visited by a nurse attending upon a child with chicken-pox on the last or last day but one, of November. On December 14th this little girl has signs of chicken-pox, well marked on December 16th. A possible interval of sixteen days.

CASE 6.—A boy, aged seven years, brother of the above, at home with her, is taken ill on December 27th, with full eruption on the 28th.

CASE 7.—A boy, aged five years, of the same family, absent during the illness of his brother and sister, is brought home to them on January 12th because a child in the same room where he is staying has chicken-pox; he begins to be ill on the 21st, with the full eruption of chicken-pox on the 22nd and 23rd. Ten days' interval.

CASE 8.—A boy, aged seven years, returning home from a visit on January 6th, sickens for chicken-pox on April 13th, and is ill with it on the 14th and 15th.

CASES 9 and 10.—Two elder brothers return home from school on April 10th, and are much with their younger brother up to the time of his illness; both show slight signs of the disease on the 23rd; the younger of the two has high fever and full eruption on the 26th, and is some time before he recovers. The eldest, aged sixteen years, who is known to have had this complaint in infancy, shows signs of rash on the same day, but the spots do not become vescicular; they are most numerous on the exposed parts of the body, namely, the face and hands, appearing first around some recent scratches on the wrist; further rounded red spots, slightly raised, show themselves on the second day, but there is no fever, and the spots fade on the third and fourth days without any of them producing pustules or even vesicles.

VARICELLA WITH WHOOPING COUGH.—A boy, aged five and a half years, at a day school where there is both whooping cough and varicella, after a slight cough barely exciting suspicion, stays at home on March 8th with spots of varicella, these are full on the 9th and 10th; he is not very ill on the 11th, and is sent to school in the following week; a week afterwards (a fortnight after the eruption), on the 25th, his cough again becomes frequent, and is very severe, with illness characteristic of whooping cough on the 31st; this continues for three weeks, when the febrile disturbance terminated with the formation of pus in an old psoas abscess; the cough continued to be spasmodic, but not very severe, for more than another month. *Vide* case 27 of measles.

CASE 12.—A younger brother, two years of age, has febrile disturbance attributable to the ingress of whooping cough during the week that the elder one is at home with varicella; this febrile disturbance suddenly subsides on March 20th; there was a great diminution both of gastric and pulmonary irritation on the 24th, and on the 26th the spots of varicella appeared in great numbers with the ordinary febrile disturbance, which however did not subside as quickly as usual, and, on April 1st, he had a temperature of 100.4°, the crusted spots of the varicella still very numerous, and the whooping cough more marked than before accompanied with vomiting. Here the presence of whooping cough had prolonged the incubation period of varicella to nearly its extreme limit, viz., fifteen or sixteen days; the varicella had intercepted the course of the whooping cough for a week or more, and in all probability modified its subsequent course, for the child, though delicate, made a good recovery, and had less trouble from the cough than either of the others in this family. This boy is case 28 of measles.

An infant at the breast, a girl aged four months, who was about to be vaccinated, has this operation delayed until March 31st, because of varicella, which appeared on March 22nd, ten days after the elder boy's illness. The day before the varicella showed itself the mother feared the child had either taken cold, or that whooping cough might be threatening; a similar fear was expressed on the day before vaccination, but on that day there was no indication of illness sufficient to warrant a further delay. The vaccination took readily, the vesicles were mature on the eighth day with areola on the ninth; the areola was not delayed, as Jenner noted it to be in measles and scarlatina; the after subsidence of temperature was not so marked as usual, previously the febrile action had been slightly accelerated, that of the seventh day being rather in excess of what is usually met with, and now a cough, noticed from the day after the vaccination, became suspiciously like whooping cough; on April 10th there was still redness of the arm; this was less on the 14th, and the febrile disturbance had subsided. There were no pulmonary *râles*, and the child seemed well, except for some fits of cough, with coryza: during this week the cough became very violent. On April 24th sickness followed the cough, and the act of sucking excited it; the crusts of vaccinia had not separated. The child became thin and ill, with more than one complication to give rise to anxiety which was not at an end until the middle of May, when a succession of small boils appeared under and near the vaccination marks. The eldest boy in this family who had whooping cough with measles (case 26 of measles), now escaped.

Mumps has fourteen days of incubation, which may be extended to three weeks; twenty-two days being the longest period that has come under my observation. The boy (aged twelve years, case 10 of measles), who must have contracted both measles and mumps at school before he left on March 20th, has signs of mumps on April 9th, exactly three weeks afterwards, and ten days after the rash of measles; he was removed on March 30th to a house where there were four children who had had measles but not mumps. They all four have mumps from the 23rd to the 25th of April, the shortest interval being fourteen days. Six cases in another family give an interval of from nineteen to twenty-four days.

CASE 6.—A boy, aged eight years, attending a day school, who had not seemed very well for a week, has stiff neck on March 20th, 1870, and next day is febrile, with parotitis. His next younger brother and the nurse have mumps on April 8th, eighteen days. Two sisters sicken on April 9th and 10th; the mother on the 12th, and an infant, aged one year, is febrile on April 12th, and has enlarged parotid and submaxillary glands, with a temperature of 104.7° at night on April 14.

CASES 13 to 16—in another family, are these: a boy is sent home from school unwell on March 11th, next day he is found to have mumps; on the 14th, a brother and sister, separated from him the day before, are sent to different houses, they remain free from symptoms till the 25th, when the girl complains of stiffness in the neck while eating her dinner, and next day has obvious mumps, thirteen days after the separation. The younger boy (case 14) has no disturbance of health until April 2nd, he was sent home on April 3rd, and next day, exactly three weeks from his leaving home, the parotids are swollen and the disease established. Three weeks after this a servant in the house (case 17) is taken with the disease on April 25th.

The last part only of this long incubation is probably infectious; the febrile disturbance is seldom marked until the day before the glandular enlargement is felt; sometimes various symptoms of illness are noticed before this; the healing of a wound in a strong lad was arrested for a fortnight until mumps appeared; a tall delicate girl felt weak and fainted still earlier in this stage, and before infection could possibly be imparted. Infection might persist for more than three weeks where the salivary secretion is contaminated, or ulceration near the orifice of the ducts persists. A specific micrococcus has been found in the clouded epithelium of the affected glands; also in the blood, by Karth, and by MM. Cabitan and Charrin. and in the renal secretion by M. Bouchard. Certain metastases are common; the more dangerous complications are rare.

Where children are exposed to the infection of both mumps and measles at the same time, the measles, even if delayed in its development, will always precede the mumps, though some of the initiatory stages of mumps would seem to have been accomplished in the meanwhile, for it is only nine or ten days after measles that the mumps appear, instead of after a fortnight, which is the shortest period of incubation for mumps; or after three weeks, at which interval whooping cough is generally found to follow measles. In whooping cough following measles, it frequently happens that the measles only is communicated while at its height, (for there is reason to believe that in early convalescence from measles, or especially if measles have followed whooping cough, that both may be communicated) so, where mumps and measles have been taken together, it may happen that measles only was communicated as in the following instance :—

CASES 18 and 19.—Two boys attended a day school in the spring, where cases both of mumps and of measles had recently occurred ; the elder of these boys has to remain away for a week from illness, sufficiently severe, but of no marked type ; the younger continues to attend the school till at the end of the week he has the catarrhal symptoms of measles ; both boys have the rash of measles together, and a younger brother, who does not go to school, is allowed to remain in the same room with them, and indeed has been sleeping in the room with the elder all the week, the youngest boy is just beginning with the catarrhal stage of measles when the eldest shows signs of mumps, and two days afterwards the second boy has mumps ; the youngest was removed to another room as soon as he became ill, and did not afterwards take mumps.

CASE 20.—A lad, aged fifteen years, left school on December 17th (one of his schoolfellows, with whom he associated, began with mumps the day before) ; he has no feeling of illness until December 24th, when he was restless at night, next morning he vomited, and then felt better ; on the 26th he was able to skate, though easily tired ; he came to London on December 28th on a visit, and was noticed not to be looking well ; he felt and looked better on the 30th, except for some swelling under the right ear ; there was increased swelling with pain and illness, next day, December 31st. The submaxillaries were swollen on January 5th, the left parotid on the 7th, and he was well again, except for almost imperceptible swelling of the parotids, on the 12th. For the latent period ten days, and three to five days for the stage of invasion.

Six schoolfellows who left school on the same day had mumps about the same time—all early in the new year—between a fortnight and three weeks after exposure. In this case the disease cannot be said to have begun until the fourteenth day after leaving, viz., on the 30th of December; the sickness on the 25th can hardly mark the commencement of the invasion period, for no infection was set up till three days after, thus leaving ten days for the period of latency which, as other cases show, may in this complaint be easily extended. Infection can hardly be said to have begun in this case until the first local signs (which in other instances are shown to follow very quickly upon the first progressive elevation of temperature) were perceptible. Five children were at home with him from December 17th to 28th, none of whom took the disease ; he returned home also after a fortnight's quarantine, and did not communicate it to others. Case 14 shows that for preventive quarantine, where it is doubtful whether the poison of mumps has been received, fully three weeks must be allowed ; here again, a short limited exposure with complete separation does not, any more than in measles, serve to mark the shortest incubation period, but may, in fact, be followed by a longer interval of freedom from all signs of the disease than when the exposure had been more complete and continuous.

The close parallelism between the ingression of the diseases hitherto considered is worth notice; an initial fever generally marks the invasion period; this, in measles, is often to a considerable degree, sometimes nearly equal, but never quite, to what takes place at the acmè just before the eruption; at others it is either less obvious, or attention is withdrawn from this part of the illness by the temporary depression of temperature that follows it. This, however, has but little practical importance, for it is not until progressive febrile disturbance, easily recognised by the thermometer, marks the real beginning of the disease that infection begins. This usually is four days before the eruptions of small-pox and of measles (probably not so long before mumps), and only one, or at most two, days before the specific indications of chicken-pox and rubeola.

Whooping cough may be considered at the end of this group, though many of its affinities are with disease of the other class. Facts are wanting to show what is the period of incubation; this stage being frequently prolonged or overlooked, is one great cause of the extensive spread of this disease, for it is quite as infectious in the early catarrhal stage as when the whoop is developed. The incubation period of whooping cough may be as short as one week only; but a separation of more than a fortnight must be allowed for quarantine purposes. Both these points are illustrated by the following cases; they also show that whooping cough is infectious in its earliest stages before the whoop is developed.

Case 1.—A girl, aged twelve years, is brought home to a family with whooping cough on July 25th, has spasmodic cough on the 30th with bronchial râles and the whoop on August 2nd, the eighth day after. It is rare to meet with the whoop until the second week, but not, I believe, to find evidence of the disease within a week of exposure.

Cases 2-5.—The younger children of a family in the north-west of London associate with another family in the Square Gardens, who after an absence from home, return from the seaside at the end of August with whooping cough; after September 2nd there is no further communication between the families, but during the week one child, a boy, aged six years, has a cough, which by September 7th becomes frequent. An elder sister, aged fifteen years, who is a good deal with this boy but had not been in the Square Gardens, is sent from home to escape the cough on September 9th. During the next few days all the younger children begin to cough, but letters from the elder state that she has escaped and is quite well; this is considered to be most fortunate, as the aunt at whose house she is visiting has an only daughter, eight years old, who has always been considered delicate, and who is watched with care. On September 13th the elder girl first makes mention of a cough, she afterwards describes this as "fidgetting," and complains that she could not sleep at night. On the 19th she is seen by the doctor, who is unable to recognise any of the distinctive signs of whooping cough; next day and the day after more violent paroxysms of cough leave him in no doubt as to its nature, though she felt better herself and was able to sleep when the paroxysm of cough was over. The cousin, who had never occupied the same room at night, was now kept more apart during the day, but it was too late; a short irritative cough commenced, and by the end of the week she becomes languid, and is soon prostrate and febrile. The character of the cough was quite pronounced by September 30th, and was afterwards very severe. A serious illness continued till October 16th.

The infection of whooping cough can be conveyed:—

CASE 6.—A stout boy, two years old, quite well except for cutting the two last molars, is visited by some friends on November 20th who have a child at home with whooping cough; this boy coughs on November 24th, and is seriously ill with lobular pneumonia the last three days of November and the first two of December. On December 8th there is no pulmonary mischief, but he has short cough, worse at night, with thin loose secretion, and whoops on December 15th. This and Case 1 give the short limit of incubation.

Most of the cases under my notice give quite a week for incubation, and a week or rather more for the febrile or catarrhal stage, so that the whoop is seldom developed until after a fortnight from exposure. Some cases have been observed by Dr. Bristowe with a clear fortnight of incubation.

In the course of whooping cough an intercurrent inflammation often stops the whoop, a fact impressed into the service of various theories; such accidents certainly interrupt and probably delay the ordinary course of the disease; what often happens in the more advanced stages of the disease sometimes occurs at the commencement, as in the last case given, when pneumonia occupying five days of the ingress, the whoop instead of appearing on the first week of December, was delayed till the 20th, and this is frequently found to be the case from much slighter causes. If such prolonged intervals are to be considered as "incubation period" then is whooping cough closely approximated to the diseases previously treated of, and it may be concluded for all lessons of practical precaution, as in those cases, so here, that if a child has been exposed to infection, a fortnight may elapse before the symptoms of illness are declared, nor can such child be considered free from the chance of conveying infection until after three weeks. On the other hand, while it is probable that small-pox could hardly be communicated for the first eight or ten days from exposure, or mumps for nearly a fortnight, whooping cough has the dangerous prerogative of being communicable from the earliest symptoms that may appear within three days of infection, as well as by the later manifestation of the disease, that may be delayed if not indefinitely, at least for two, and perhaps even for three months.

The poison of whooping cough, like that of scarlet fever and others, may be intensified both by the re-infection of those in certain states of weak health, or by being concentrated where several sufferers are congregated or kept too much confined either in small rooms or else in the same room. A case is given in my *Temperature Variations (vide* p. 43, *et ante* p. 76), where a child was in considerable danger until removed from the room where another was ill.

Fatal consequences resulted in the following case from this cause, further intensified by allowing the body of the sufferer to remain in the dwelling:—

A girl, two years old, while teething, has a cough at first attributed to that cause, but suspected to be whooping cough on February 2nd, and recognised as such on the 10th of February when a brother, four and a half years old, occupying the same room, has a similar cough. On this day the mother gives birth to an infant, who, thriving very well for the first week, after that is noticed to pine and have difficulty in taking the breast—there is no doubt of the infant having whooping cough, on the 24th of February, it was sick with its cough, and before the end of another week could hardly suck, as the first touch of fluid in the fauces induced violent spasm. On March 1st the infant dies; at this time the little girl's cough was improving greatly, and though the boy's cough was violent he was otherwise doing well, he had a strong well-formed chest. Instead of the infant receiving prompt burial it remained in the room, there were but two on one floor occupied by the family, until March 8th, when, in spite of disinfectants, an offensive atmosphere was induced. On March 10th the boy's cough had increased, the fauces became red and irritable, there was viscid phlegm in the mouth and difficulty of taking food; on the 17th he had dysuria, with marked pyrexia, afterwards convulsions, and death on the 24th of March. The girl's cough was also increased at the same time, but her health improved by the end of the month, and after April 2nd her convalescence progressed rapidly.

A frequent mode by which the poison of whooping cough spreads, is by persons who have previously had the complaint, while much with the sick, suffering a second attack in a modified form, which, by not exciting alarm, leads to neglect of the requisite precautions against conveying infection. Germs readily attach themselves to surfaces, whether articles used by the sick or near them, and to the clothes of attendants; these infecting particles, probably minute solids, cannot be wafted far, they may be carried by the healthy, but the most frequent mode of diffusion is by liberation from the breath of the sick.

Scarlet fever is the typical example of my second class of infectious diseases to which these latter properties, that are also attributable to whooping cough, belong. The incubation period is essentially short, and may be very short, even to a few hours, the more usual period is from three to five days. A necessary question arises as to how long may this period be extended; the longest interval hitherto met with has been eight days, and when children have been removed from a scource of infection if any have taken it they will most probably sicken within a week. This generally is true of diphtheria, but here it may extend to a fortnight, of which some instances have come to my notice.

Scarlet fever is not so infectious during the first day or two of sore throat as it afterwards becomes, so that an early separation gives good hopes of immunity, especially if the exposure has not been at very close quarters, such as sleeping in the same bed; even a moderate distance, about two yards, between children's beds, is some safeguard. Persons suffering the sore throat, so often experienced by those who, having previously gone through the disease, attend upon scarlet fever, are not free from the fear of infecting others while such short illness lasts, if not afterwards; an instance has lately come under notice where a nurse had such a sore throat, with aching of limbs, and only a slight degree of fever, enough, however, to oblige her to go home for two or three days; her husband who had never had scarlet fever, takes the complaint with great severity. Infection is over sooner in second attacks.

The way in which the infection of scarlet fever clings to surfaces and rooms is well known, it may thus lie dormant, as in the case of small pox, for months or possibly for years. In this way the disease may unexpectedly make its appearance, when by some chance a debilitated or susceptible person is confined to the infected chamber, or exposed to slight traces of infection that may linger on clothing. The latter cause is illustrated by two cases occurring on board ship, published in the *Lancet*, September 3rd, 1864, p. 279, by Dr. W. M. Saunders, R.N. A naval cadet of H.M.S. *North Star*, has symptoms of scarlet fever on February 21st, 1842; the ship left Madeira, the last land touched, on the 1st of January, where the lad visited at a house wherein some children had recently had scarlatina.

A midshipman of H.M.S. *Shannon* was put on the sick list 2nd May, 1857, for a wound of the foot; on the 7th of May he was attacked with febrile symptoms which proved to be those of scarlatina. The ship anchored in Simons Bay, Cape of Good Hope, on the same day, not having communicated with the shore, or with any vessel since leaving England, on the 25th of February. The *Shannon* was at Portsmouth, in February, 1857, when some children near this young man's father's house at Southsea, had scarlatina. Here, although the infection had lain dormant for nine weeks, it becomes operative in the usual period of incubation, five days, after a susceptibility is induced by the wound.

An instructive instance of continuous exposure to the poison of scarlet fever becoming dangerous only upon the receipt of an injury is given by Mr. Henry Veasey, of Woburn, Bedfordshire, in the *British Medical Journal*, 1869, vol. i., p. 113. A servant, aged 30, in a family where scarlatina had prevailed two months previously, with desquamating convalescents in the house, but no new cases of fever for the last month, cuts the knuckle of her right middle finger against a child's broken mug, on May 27th. The wound was contused and painful, it was the girl's menstrual period. She is sent home the same evening. Next day she has rigors and erysipelatous swelling of the hand. Her illness was extreme for some days. On the fifth day, May 31st, there was sloughing at the seat of injury, vesications in the right arm, rash on the neck, chest, and left arm, with sore throat, full rash, and all the characters of scarlet fever well marked by evening. The patient recovered. A nurse in attendance upon her at the height of the illness, going home at night, takes the infection with her, and on June 3rd, the nurse's child aged 3 years, has sore throat, and scarlatina rash well marked on three subsequent days.

It is not likely that the poison of scarlatina was introduced only by the wound in the hand; doubtless, material had already been received sufficient to set up the disease, when the accident gave it a starting point. The first evidence of small-pox, measles, and varicella will appear at, or near, a recent wound or abrasion of the skin, when the special infection must have been received days before the injury. Sir James Paget, in his clinical lectures, gives instances of scarlet fever following upon surgical operations; most of these are from the nurse having introduced the infection at the time of the operation or soon after, the disease appearing at a time closely corresponding to the ordinary incubation period of scarlet fever. In one case of lithotomy in a boy, followed first by scarlet fever, soon after that by whooping cough probably taken during convalescence, there is reason to believe that the poison of scarlet fever had already been received before the operation; the first signs of scarlet fever gave way to suppuration from the wound, after that had ceased the scarlet fever symptoms returned and went through their full course after a fortnight's interruption; how long such an interruption and delay in the development of scarlatina may be prolonged is uncertain;

ten or twelve days would be a short time to allow for such a possible extension of the incubation period, and consequent quarantine limit. It may be that the complications of intercurrent disease, by interrupting the morbid process of scarlet fever in their midst, tend to prolong the subsequent duration of infection as in the following case.

CASE 1.—A girl, aged 9 years, probably exposed to scarlet fever on January 13th, has the first symptoms on the 14th; on the next two days there is delirium and a full eruption; this subsides on the 19th, when articular rheumatism began. Pericarditis, with effusion, existed as a serious complication from January 24th to February 10th; there was then some otitis and paralysis of the palate, and afterwards of the abdominal muscles. Convalescence having fairly set in, after a month's quarantine she is sent into the country, on March 20th, to join other children of the family, nine weeks and a half, or sixty-six days after the commencement of her illness. A younger brother meets her at the railway station, and, in returning home, sits opposite to her in a close carriage. On March 22nd this boy is ill, he vomits, and is very restless at night; next day has sore throat and rash, with full rash on the 24th and 25th; the illness is severe, and continues to the end of April. Two children, one older and one younger than this one, escape.

Another instance of the length of time scarlet fever continues to be infectious is the following, in which there is no important complication to draw attention from the fact that personal infection may linger, not only far beyond the time of desquamation, but after the clearing away of the last visible morbid product of the disease.

CASE 2.—A girl, 10 years old, comes from school on July 4th with scarlet fever; the attack was severe, but uncomplicated. Throughout August one nostril is tender and obstructed, the tonsil on the same side is full; there is eczema of that ear. On August 14th, six weeks after the commencement of the illness, this girl is sent to the sea-side, where she joins her two younger brothers; the youngest, aged 5 years, has sore throat on August 16th and the full rash of scarlet fever on the 20th.

CASE 3.—The other brother, aged 9 years nearly, is separated from the younger, and returns to London with the convalescent sister, who has now no vestige of the illness, on September 4th; they stay at the house of a friend, who has one grown-up daughter, in whose room the girl sleeps, from the 4th to the 10th of September; the boy goes to his own house on September 6th, he has slight sore throat on that day, is feverish on the 9th, and full rash on the 10th.

CASE 4.—The young lady with whom the girl was staying, is taken suddenly ill on the afternoon of September 10th, with headache, lassitude, and chills; next day she vomits, and has sore throat, with intense aching of limbs and prostration; there is the full rash of scarlet fever on the 12th. These attacks either originated from the girl, again nine weeks and a half, or sixty-six days from the commencement of her illness; or the boy communicated scarlet fever four days before he is himself ill; he probably contracted the disease before leaving the infected house, as the symptoms appeared within three days of leaving it.

To give all the instances of short incubation in scarlet fever would be to exhaust a record of cases more numerous than those of measles. It sometimes happens that of children with equal exposure to either infection one escapes. In measles there is danger of attack while the children remain together, even after a month or more has elapsed, but if they are separated, and the room and clothes disinfected, the danger of a fresh outbreak is little or none; this is not the case with scarlet fever, when local causes of disease may remain after every means of disinfection have been practised.

CASE 5.—Of two young children, one, a girl, has an illness in June, which, after some days of uncertainty, is recognised as scarlet fever; it is considered too late to separate them, and on the appearance of some slightly suspicious symptoms, the other, a boy, is placed in the same bed with the girl; he was soon better again, continued much with his sister throughout the illness and during convalescence; they both make a long visit to the sea-side, and return to their house early in October; within three days of their arrival the boy is taken ill.

Every care had been taken to disinfect the house, and special care as to the room and everything in it; the child's bed had been near the fire-place, and at the foot of a mahogany polished bedstead, with rounded end; on washing this surface with diluted Condy's fluid, the end nearest the child's bed discolored several basinfuls; the corresponding round end of the footboard furthest from the child's bed caused hardly any discoloration; some shells used as playthings by the sick child also required repeated washings, others exactly similar not used by the child did not change the weak solution of permanganate of potash used. The local cause of infection here was traced to a neighbour having converted the rain water pipe, which had an opening near the child's bedroom window, into a soil pipe for a water-closet.

In another case of doubtful scarlatina occurring to a little boy (Case 6), during hot weather, commencing with diarrhœa, on July 10th, the symptoms had so rapidly disappeared that he was allowed to mix with other children on July 16th; on the 19th two other children were ill with scarlet fever.

CASES 7 and 8.—Of two little girls living in an isolated, perfectly healthy house, the elder, four years of age, has a rash on February 21st, thought to be measles, and attributed to contagion from a child met with on February 17th, when she was taken to a London hospital, this being the only occasion for some time on which any communication with others could be traced. On the evening of the second day after this, February 19th, the child vomited; on the 20th she had sore-throat; the rash now appearing was evidently that of scarlet fever. The younger child, aged two years, was also ailing on the 21st, and seemingly had some difficulty in swallowing on the previous evening before there was any appearance of rash on the elder child. Both had rash on February 22nd, that on the eldest being most diffused and intense; next day the elder has albuminuria. They die, poisoned by scarlatina, the younger on February 26th, the elder on March 2nd, leaving their parents childless. The younger child took the complaint from her sister, if not while she was only sickening for it on February 19th and 20th, yet certainly before the 21st, when the rash appeared.

The danger of receiving anyone into a susceptible family direct from an infected place is shown in the following instances:—

CASES 10 and 15.—The eldest boy in a family of nine children returns from school on December 3rd, 1861; he had suffered from sore throat and the school had broken up before the usual holidays because of scarlet fever there. Three days after, Friday, December 6th, the mother, who was in delicate health, became ill, and next day had the rash of scarlet fever. Three girls, twelve, eleven and nearly ten years of age, now go to the house of an aunt, and the school-boy leaves home. Next day, December 8th, two of the brothers, aged seven and five years, are seized with the illness; on December 12th, five days after the separation, the girl aged eleven years returns home with scarlet fever. On the 14th one of the maid-servants is ill, and on the 15th a little boy not quite three years old is seized. On the advice of Sir Thomas Watson my services were sought. The two younger children died on December 20th and 28th, the elder boy began to amend on the 25th, the sisters' illness was less severe. The two youngest children who left the house with their nurse escaped, as also two of the elder girls who were sent away in the first instance; one of these joined the eldest brother on December 21st and suffered nothing. All joined the convalescents at the seaside on January 25th without injury.

Terrible consequences not unfrequently result from allowing children from a house or family infected with either scarlet fever or diphtheria to go direct to school; beyond the chance of infection being carried, is the certainty that if such child have only the first process of either disease set up in themselves, they will diffuse it widely before it is known to have commenced; quite recently a widely-spread outbreak of diphtheria originated in this way: a scholar continued to attend school while a member of the family at home was ill with diphtheria, no harm resulted until soon after the first symptoms of illness were felt by this scholar, and though further attendance at the school then ceased, nineteen children in the school were attacked. The closest correspondence is found to exist between the laws of infection in scarlet fever and diphtheria, as is fully set forth in the article on the latter disease, in the first volume of Reynolds' *System of Medicine.*

Influenza is more closely connected with scarlet fever and diphtheria than is commonly known. Prevailing under two forms, the catarrhal and the herpetic, it has an incubation period closely corresponding to what is observed in those diseases: this may either be very short, or may occupy three or four days, but will not extend beyond a week. The shorter period generally obtains in the catarrhal form, the longer in the herpetic. The two forms, though most frequently propagating their own specific characters, are capable the one of giving rise to the other; instances of this are given in my *Temperature Variations*, p. 33; perhaps the more frequent being from the catarrhal form to the herpetic, but they are really interchangeable. It would seem that the poison in a diffused state, acting on a healthy person under healthy conditions, may be rapidly thrown off with catarrhal secretion, while the same poison if concentrated and acting in different conditions of health, or under insanitary surroundings, may show itself less quickly but with more profound effect. Hence the affinities of herpetic catarrh with croup, ulcerated sore-throat, and diphtheria; those of influenza when mild, with common cold and diarrhœa. What in the winter is cough, in the summer affects the gastric mucous membrane rather than the pulmonary, resulting in diarrhœa; this may go through a household, as does catarrh: one person visiting another with summer diarrhœa, and staying in the sick room, is liable shortly to be similarly affected. The epidemic form of influenza has some affinity with scarlet fever, both in the rapid action and in the intensity of the contagion; influenza, though acting on different tissues, and productive of less serious lesions, is much more readily spread by atmospheric, or other less appreciable, modes of conveyance.

Typhoid or Enteric fever, with an incubation period generally of ten or twelve days, which may be considerably prolonged, may also be developed in so short a time as four days. Dr. Clifford Allbutt records* the exceptionally short interval of five days in a child after sleeping one night with a nurse ill of enteric fever; the evidence if not quite conclusive in this case is presumptive of the possibility of so short an incubation period. One case of enteric fever from tainted milk which came under my notice occurred on the fifth day from that on which alone the poison was imbibed. Dr. Murchison† gives a case from Knævenagel's work on the Etiology of Typhoid of a man who falling into a latrine has typhoid fever eight days afterwards, some of the poison probably being received by inhalation at the time of the accident.

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* *British Medical Journal*, 1870, vol. i., p. 480.

† *A Treatise on the Continued Fevers of Great Britain*, by Charles Murchison, M.D., LL.D., F.R.S. Second Edition. Longman, Green & Co., London, 1873, p. 469.

An instance of definite and short incubation of enteric fever from inhalation has come under my own notice in a house near Grosvenor Square, most carefully guarded against the entrance of sewer gas and the usual sources of water contamination, the pipe drains being well ventilated by air tubes from below the trap of each water-closet to the roof. A change in the main sewer obliged the house drain to be carried from the back to the front of the house; for some days in May workmen were employed in putting new pipe drains in the previously undisturbed basement; from this work no mischief could arise until the old communication with the outer drains was severed or the new one opened. From the memorandum of the work done, supplied to me by the contractor, the period of danger appears to have been limited to three hours, on Saturday, the 24th of May. No defect was noticed in the portion of the drain removed, unless there had been slight leakage from the scullery sink at the back of the house, this was remedied on Friday, the 23rd, and lime was added to the earth surrounding the new drain. The opening in the basement of the house where the old drain passed through was closed with cement.

Beyond a somewhat sickly smell under the sink, removed by the lime, nothing disagreeable was noticeable until during the three hours on Saturday, when one of the servants, a delicate woman of thirty, complained more of it than the others, and consequently went out in the evening for fresh air and to see the illuminations on the Queen's birthday. She made no further complaint, nor did she feel any illness until seven days after, when, on Friday the 30th of May, she again felt nausea, and returned from a walk tired, with a fixed pain in neck, and diarrhœa; at night she was sick, the diarrhœa continued; she complained of chills, headache, night fever, and restlessness, with occasional vomiting, and persistent diarrhœa. On June 5th her evening temperature was 104.3, with nearly the same elevation for the next five days, the morning temperature ranging from 101° to 101°.8; at this time very characteristic rose spots appeared. By June 15th, the diarrhœa and febrile disturbance were moderated; there was slight nocturnal delirium and great prostration. In the last week of the illness, bronchial râles, with free expectoration, a tendency to constipation or inactivity of the bowels, and considerable emaciation; very little solid nourishment could be taken till June 30th, when she first left her bed. No one else suffered in the house. The milk supply was unexceptionable. This servant had no friends in London, had visited no other house, nor taken either food or drink elsewhere.

The most frequent source of enteric fever is the diffusion of the poison in drinking water, whether contaminated by direct admixture of sewage, or tainted by sewer gas. The outbreak at Guildford, investigated by Dr. Buchanan,* affords definite data for estimating the ordinary incubation period of enteric. A new well for the supply of water by steam power to the higher parts of the town of Guildford was constructed in fissured chalk, in such proximity to the old sewer that contaminated water was pumped into the reservoirs until August the 1st; from that date to August the 17th, the high service drains were charged from the old well, when from some interruption to this source of supply the water stored before August 1st in the new high service reservoirs was distributed to 330 houses. "It was distributed on no other day, and to no other houses, and on these 330 houses the fever almost exclusively fell." The first cases happened on the last three days of August; houses that had no cisterns, but took their supply direct from the mains, were attacked particularly early and suddenly; many houses had cisterns, or large underground tanks, in which the water received on August the 17th would be stored. Other cases of enteric fever came under observation in the first two days in September, and on September the 3rd and 4th a surprisingly large number of people sent for medical assistance, and were found to be suffering from the same fever. During the month, 264 cases of fever were under treatment. Dr. Buchanan fixes the occurrence of the first symptoms, in a great proportion of the cases, eleven days after the operation of the cause. A fact of interest in connection with the transitory operation of the cause is the low death rate, only three cases died in September. The total number of cases was 500, of the deaths 21; the last death was on November 22nd.

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* *Tenth Report of the Medical Officer of the Privy Council*, 1867, p. 34.

Much uncertainty as to the time necessary for the development of enteric is owing to the difficulty of ascertaining how long, or how continuously, its cause has been operative. Some persons exposed to it would escape with slight symptoms of malaise, did not a continuance or a repetition of the exposure at length overcome their powers of resistance, and they fall victims to the disease, not from the effects of the last only of the exciting causes; yet if this alone were taken into consideration the period of incubation would be unduly shortened. Others, after or during exposure, suffer from diarrhœa, and may escape with no other symptoms, unless by sudden interference with the accustomed eliminative effort, or some other change of condition, the disease is set up; hence the incubation period may be unusually prolonged. My friend Mr. W. Adams was attending a gentleman for troublesome diarrhœa persisting for more than a fortnight after his return from a continental town of bad sanitary odour; the diarrhœa aggravated an ulcer or fissure of the rectum, and the pain was so intense that the usual operation was necessitated; while the incision was suppurating freely no diarrhœa and no discomfort occurred, but on the complete healing of the fissure a sudden rigor ushered in a rise of temperature with evening exacerbations, ochrey diarrhœa began, there were rose spots in the second week, and all the symptoms of enteric fever continued their usual course.

A convalescent patient probably does not give off infection long after the symptoms cease; but for how long enteric fever might in this way be carried to distant parts is indefinite; that it may become active long after it has found its way into water sources is well known. The poison of enteric, like that of cholera, acquires increased activity after it is thrown off from the human body, under the cooperation of heat and moisture upon filth; contaminated water is the great medium of conveyance for these poisons, whether by direct entry, or by subtle particles of them diffused into the air and condensed on to water surfaces, or carried by sewer gas into drinking water. Personal infection is rarer in enteric fever than in any other of the diseases under consideration, yet the infection, however propagated, derives its origin from persons previously affected. Certain forms of illness of irregular duration, generally shorter than that of enteric, and often characterised by diarrhœa, are probably owing to the poison of enteric fever, and may reproduce it. A form of malarial disease with symptoms closely simulating those of enteric fever, often of longer duration without relapse, has been called typhomalarial, *Medico Chirurgical Transactions*, vol. lxix., p. 247. The cases of malarial enteric there mentioned shew a much longer incubation period than that established for ordinary enteric fever. For a full discussion of this subject see a paper by my son, Dr. J. Edward Squire, in the *International*, or, *American Journal of the Medical Sciences* for April, 1887.

Typhus has been so exhaustively examined in the masterly essays of Dr. Murchison, that it becomes merely necessary to refer to the second volume of the *St. Thomas's Hospital Reports* for 1871, new series. The incubation period is mostly twelve days; of thirty-one cases there collected seventeen occurred at this limit; one case in not less than thirteen days; one in fourteen days; one exactly fifteen days; and in one it was not less than twenty-one days. Ten cases, or nearly one-third of the whole number, fell below the limit of twelve days; of these, in two it was not more than ten days; in one not more than six days; in one exactly five days; in one between five and a half and six days; in two not more than four days; in one not more than two days; and in two there was no latent period, or only one of a few hours. In this disease it is to be remembered that the distinctive rash does not appear till the fourth or fifth day of illness. The remarkable way in which the infection of this most infectious of diseases is diluted and soon destroyed by free ventilation and fresh air is forcibly stated in the great work on fevers already referred to; one statement there, however, requires correction: instead of convalescents from typhus not having the power of spreading the disease, a medical friend of my own, impatient of precaution during rapid convalescence, hastened from London to a distant part of the country, and communicated typhus in two remote villages where nothing of the kind had previously been known. A recent instance of the spread of this fever by convalescents occurred in the late epidemic at a charitable institution in Hammersmith.

Relapsing fever is conspicuous for the shortness of its incubation period. Instances of persons attacked at once upon exposure to sources of strong infection are reported. In the Camberwell workhouse, tramps received at night to infected quarters were found next day to be suffering from the disease. The cases related by Sir Henry Marsh,* where the febrile rigor succeeded immediately to the application of the contagious effluvium, were most likely of this kind. Very clear instances of a five days incubation period have been recorded of this disease, and it has been stated to be oftener over than under five days. Of twelve accurately determined cases, three were immediate; two from two to four days; two were five days; and one each took seven, nine, twelve, thirteen, and fourteen days. The possibility of latency to the fourteenth day has, however, yet to be determined. The disease has been produced by inoculation. A drop of blood taken by a doctor during a febrile accession, when the *spirillæ* are most active and numerous, for self-inoculation reproduced the fever in five days.

Yellow fever usually with a short incubation period of from two to five days, and rarely exceeding eight, has yet been stated sometimes to extend to ten days. In the thirty-eight cases reported by Inspector-General Lawson on board the *Bristol*, some began to appear two days after exposure;

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* *Dublin Hospital Reports*, vol. iv., 1827, p. 455, case 5; see also pp. 518-20.

twenty-nine of them occurred in the first eight days; the one exceptional case was a week after the others, thus suggesting the possibility of reinfection. This case falling fourteen days after the original exposure, cannot be used to justify a quarantine of a fortnight's duration, for the possibility of this length of incubation period is not beyond doubt. In hot climates infection clings to places and ships. One attack protects from a recurrence.

Plague, now nearly extinct in Europe, is fortunately characterised by a short period of incubation. Dr. Gregory writes, "From the concurrent testimony of numerous authors, we are warranted in saying that the period of incubation of the true pestilential germ is very short. Two days has been stated as the minimum, and fifteen as the maximum; five days may be looked upon as a fair average. Four days suffice to set up the constitutional symptoms when the plague is received by inoculation." The shortness of the incubation period offers an additional character to those noticed by Dr. Tholozan as distinguishing plague from typhus.

Malignant pustule, anthrax or *charbon*, like plague has usually four days incubation, but may start at once from inoculation, with rigor as soon as the pustule begins; or the pustule may precede the rigor by four days (see *Pathological Society's Transactions*, 1883, p. 291). This disease, known as Splenic Fever in animals, has afforded a means of studying the relation of a specific germ, the *bacillus authracis*, to the disease associated with it; this analogy reaches to our own infective fevers, and the action of disinfectants upon the various "germs" associated with them. Even if the germ only excites a process, or develops a secondary product, to which some symptoms or after effects may be attributable, and indirectly causes disease, whatever hinders this germ development has some effect in controlling the result.

Rabies, or hydrophobia, another disease which is propagated by animals, deserves notice, not that it ever should be allowed as epidemic, but because of the evidence of the singularly lengthened incubation it affords. The inoculations of M. Pasteur have shewn that this disease does not recur after recovery from a modified form of it. The long period of latency for rabies after infection has always been remarkable. Galen* himself saw a case after a year.

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* Comment. ii., in Prorrhet. Hippocrat (Mead's *Works*, p. 77).

There is a recent instance of this long interval. Professor Gamgee* refers to a still longer period. Dr. Mead† says: "I remember one after eleven months; but the attack is generally within thirty or forty days, though possibly sooner in young subjects. Nothing seems more wonderful in this whole affair than that the venom should, as it were, lie latent in the body so long a time before it discovers itself. This in different constitutions will be done in a different space of time: nay it may so happen that this ferment being weak, and the constitution strong, no visible mischief may ensue, till some accidental alteration in the body unluckily gives it an additional force." He gives the case of a lady who had pain from the bitten part every month, until on the fifteenth recurrence it became fatal rabies. Sir Henry Marsh‡ relates the case of a boy twelve years old bitten by a dog with incipient rabies. "Four weeks afterwards, whilst playing, he was thrown by his companions into a ditch; he went home wet, chilled, and complaining that he felt ill; that very night the fatal symptoms showed themselves." Of thirty-one cases, all fatal, collected by Dr. Gregory, twelve were seized from twenty-six to forty-three days after; one in three weeks; eleven, from forty to seventy-seven days; four, from three to four months; and three at eight and nine months. He says, "from this we may learn to distrust those alleged cases of hydrophobia occurring *within* three weeks from the infliction of the wound, and which ended favourably."

A shortened period of incubation accompanies the dumb form of rabies, as modified by the inoculations of Pasteur; in the rabbit this is reduced to seven days. M. Regnault gives one instance of ten days incubation out of sixty eight attacks of rabies in dogs, most of these occupying from three weeks to three months. The shortest period for the development of this disease in man is a week; one such case is given by Blane. A similar instance occurring in St. Bartholomew's Hospital is mentioned by Dr. B. W. Richardson. A long incubation is fairly established by Dr. Léon Colin, a soldier bitten in Algeria, November 2nd, 1874, is seized August 30th, 1879. I have notes of three cases in children extending over two years; other instances of three months, five months, and sixteen and a half months (*Revue de Médecine*, August, 1884), are before me.

The inoculations of M. Pasteur have proved in this disease, as in the preceding specific "anthrax," that one attack is protective against a recurrence in the same individual, even though the inoculated form of the disease be much modified. It is contended that some secondary product common to either form of rabies which is inimical to the further development of the specific germ, is in this way introduced, and is preventive of the further accidents of the disease and of further liability to it. (*Vide foot note, p.* 162.)

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* Reynolds' *System of Medicine*, first edition, vol. i., p. 720. Cœlius Aurelianus, lib. iii., cap. ix., is quoted, as giving the incubation period most accurately.

† Mead on the "Poison of the Mad Dog." *Op. cit.*, pp. 77-84.

‡ "Observations upon the Origin and Latent Period of Fevers." By Henry Marsh, B.A., M.D. *Dublin Hospital Reports*, vol. iv., p. 494.

If for persons bitten by rabid dogs the proportion of those who suffer may be as low as one in fifty, this would seem to reach one in five after the bite of rabid wolves or jackals.

Dengué, an eruptive disease, is, like influenza, a pure epidemic, first attacking a few and extending its circle till few escape; the ingress is sudden, with febrile and articular pains, followed by a scarlet rash; it passes off without danger, but leaves debility, a tendency to relapse, with pain and weakness of the joints. The stage of incubation is a short one, but may extend to three or four days; one attack is not protective against another. Infection will cling to surfaces, and may linger long on board ship, breaking out unexpectedly; in 1870 this happened among troops conveyed by sea from Bombay (where it had extended from Zanzibar) to Cannamore on the Malabar coast; in 1871 the epidemic extended to Madras and thence to Calcutta, Rangoon, and Singapore; in 1872 it had extended both to China and to the Punjab. Dr. Taylor* notes the disease first in Delhi on June 1st, 1872, attacking one member in an European family that had arrived from Calcutta three days before; subsequent seizures were observed amongst persons who had been in communication with this family. The disease prevailed as an epidemic from July to November. Almost every one exposed to the cantagion caught the disease; when once it entered a house hardly a person escaped. One fatal case only is reported in the whole course of the epidemic. Common in India, where scarlet fever is rare, dengué would seem to be of African origin, and to owe its extension to the slave trade. It has not yet appeared in Europe. In the West Indies it was first described as a hybrid between urticaria and rubeola, as with us rubella is sometimes spoken of as scarlet fever and measles conjoined, a confusion of totally different morbid conditions possible only so long as the distinctive characters of a disease remain unrecognised.

Cholera, whatever may be said of its mode of propagation, is distinguished by the shortness of its incubation stage ; hence no length of quarantine is needed, if any ever be advisable. From inquiries made by the Central Board of Health in 1831, of 171 cases at Berlin 159 were found to have occurred within five days from exposure to the infective germ. At St. Petersburgh, in the cases where single exposures to infection were best ascertained, the period of incubation ranged between one and five days. In the Austrian territory, the Genoese Medical Commission observes "that those who had absorbed the germs of the disease were generally attacked before the third, and not later than the fourth day." The difficulty experienced in the early recognition of some diseases offers no obstacle to the efficiency of preventive measures against cholera. The premonitory diarrhœa generally affords an obvious symptom, and it is well known that the infection at this stage must be guarded against. One attack of cholera affords very slight, if any, protection against recurrence.

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* *Report of the Sanitary Administration of the Punjab for the year* 1872, p. 70.

Until quite recently typhus has been often confounded in India with remittent fevers : ten times the number of deaths in British India are registered under the head of "fevers" to those from cholera during the worst epidemics.* In the report already referred to, Dr. Fairweather states, "In no instance do medical officers attribute these severe forms of fever to any but a malarious origin. The manner of distribution seemed to point more to a *specific cause* than to any general condition. In the early part of 1872 typhus fever was found mixed up with the ordinary fever of the country in a jail in the north-west of India ;† it was known to have prevailed here before, but had escaped detection. How much more difficult must it be to detect the presence of a specific fever among the mass of the native population. That fevers peculiar to this country do exist few will be prepared to deny. No mere general descriptions will ever be useful in determining the nature of a disease, and it is only by an officer who can make minute clinical notes of cases, such as were made by Dr. Lombard, that the tangled skein of Indian fevers will ever be unravelled." Dr. H. Vandyke Carter has shewn, 1887, that more than one form of malarial germ occurs in the remittent fevers of different parts of India.

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* *Ninth Annual Report of the Sanitary Commissioners with the Government of India*, p. 207.

† *Report on the Sanitary Administration of the Punjab for the year* 1872, p. 68. Dr. De Renzy directed an inquiry on this point Assistant-Surgeon Lombard, by careful clinical observations, proved the fever in question to be typhus ; he caught it and died. The temperature observations made leave no doubt as to the nature of the fever of which he himself fell a victim ; yet on these very proofs, with the usual evening exacerbation, the local medical authority remarks, "The disease therefore was, as far as the temperature is concerned, decidedly remittent."—Appendix to Report.

Ague.—The London bills of mortality included many cases of enteric fever under the name of ague; the death of James I. is a probable instance. How long a new resident in a malarious district may escape, or how soon he may suffer, was seen in this country when our old ague grounds were undrained; Irish harvest men, a month in the fens, were sometimes attacked before their work was over, many were seized on their journey home, others long after their return. Malaria, short of inducing ague, produces some ill effects not immediately noticeable, but developed on some subsequent exposure to any cause of illness, even though this be experienced long after quitting the malarious district.

Malarial fevers, having many points of resemblance to epidemics like yellow fever and cholera, though non-contagious, are found also to have an incubation period which, capable of being accelerated or retarded, is yet as constant as that found to obtain in so specialised a disease as typhoid. Dr. Walter Dickson informs me that the non-contagious malarious fevers of the west coast of Africa often show an incubation period of twelve days. At about that interval, after the return of a boat's crew from a river expedition, some cases of remittent fever would occur even among the more cautious of the men; sometimes a debauch would determine the attack before this period, or bring it on at a somewhat later time in those who otherwise in all probability would have escaped. M. Littré, of the Institute of France, has ingeniously shown how the fatal illness of Alexander the Great was brought on in this way nine days after exposure to malaria in a boat expedition near Babylon.

Dr. Gregory, in the Essay already noticed, gives illustrations of the incubation period of malaria or endemic fever in Sicily, from Sir William Franklin, Principal Inspector of the Medical Department of the Army. On the 12th of July, 1810, a regiment marched from Milazzo to the neighbourhood of Messina; a detachment was subsequently sent to occupy a large mansion, the Casa del Corso, where in certain seasons no one sleeps without afterwards suffering intermittent or remittent fever. Ninety-one men were stationed here. On the 31st of July, thirteen days after exposure to the malaria, the first case of remitting fever was sent to hospital. On the 1st August, five others were reported. The following day the detachment moved from the Casa del Corso, and encamped near the rest of the regiment, which was then healthy. Yet the men continued to drop, and the admissions into hospital from this detachment were, August 2nd to 6th, one, eight, five, six, and seven men on each day; on the 7th eleven were admitted, and twelve on the 9th, after which the numbers were, four, eight, two, three, on consecutive days; then comes one on the 15th, two on the 20th, and one on the 26th day. Seventy-seven men of the ninety-one exposed to the germs of the disease were attacked; after their removal the greatest number of cases fell within twelve days, and one exceptional seizure takes place twenty-five days after removal from the malarious locality. Would the fourteen who escaped have fallen with fever had the exposure been longer? Dr. Gregory thinks not. He says, "as a proof of the intensity of the poison, of the seventy-seven attacked twenty-three died, being in the exact ratio of thirty per cent., the usual rate of mortality in small-pox, and also approximates to that of epidemic cholera." The account is insufficient to reveal the causes of this great mortality, or the exact nature of the disease. Like a true malarial remittent, it did not spread to any not exposed to the local influence.

In conclusion, the great questions bearing on all that may intensify or that can mitigate the extension and severity of these diseases must pass with bare mention. How much hygienic measures, directed by a full knowledge of the natural history of each epidemic, lessen the fatality of some and defend against others is beginning to be understood and acted upon. There are scourges of the past now only matter of history; social progress has slowly and indirectly, but most effectively, obliterated many evils inseparable from imperfect knowledge of the conditions, and deficiencies, in the means of healthy living. Plague is abolished from Christian Europe. By what means the mortality from small-pox may be annihilated is well established; even if the reactionary activity of ill-instructed intellects so far prevail as recently in Leipzig, the head-quarters of German learning, to check the employment of vaccination, the loss in one year of seven hundred children and the death of one in every hundred of the inhabitants by small-pox forcibly recalls the value of the disused protection, and limits for the future any such disastrous success on the part of anti-vaccination leagues.* Where we have no direct means of preventing personal susceptibility to disease, we lessen it by all that tends to maintain intact the vital resistance of each individual, by all that conduces to general prosperity, and by such local cleanliness and public conservancy as will maintain the purity and secure the freest supply of the water we drink and the air we breathe. The least speck of the less potent poisons finds quick inlet, and acts strongly, when the state of health is weak, or the air bad around. Free admission of air almost robs the poison of typhus of its power; in my own experience this fever was banished for a time from London by the first operation of the Common Lodgings House Act. An infection the most subtle and persistent, that of scarlet fever, has been limited to one patient in a room with other children living and sleeping in it, by preserving a separation of a few yards, and by attention to the maxim that disinfection must begin at the body of the sick. As these poisons are diluted and destroyed by fresh air, so are they intensified by accumulating in air otherwise foul; the mortality of measles is one per cent. under good hygenic conditions for all ages beyond the first year; under ordinary circumstances this rate is doubled; the usual mortality for all ages is one in thirty or forty cases; during the seige of Paris the mortality from measles in the Hôpital de Bicêtre exceeded one in three.† All clinical experience is confirmatory of Dr. Sanderson's demonstration of the increased virulence infecting poisons may acquire in transmission from one individual to another. Essential differences are shown in the various morbid poisons by another order of facts; the mortality from typhus is far less in childhood than in age; whooping cough, so dangerous to the infant, is merely troublesome to the adult. The regulations to keep out cholera would be powerless for the exclusion of small-pox. Thus, the best intentioned sanitary efforts often fail, wanting the precise information that can alone be afforded by the science of medicine.

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* La Variole au point de vue épidémiologique et prophylactique par Léon Colin, Professeur à Val de Grâce, Médecin en chef de l'hôpital militaire des varioleux de Bicêtre pendant le siége de Paris, 1870-71. Baillière et fils, Paris, 1873, p. 22. The numbers here quoted, given by Professors Wunderlich and L. Thomas, are from November, 1870, to February, 1871.

† Léon Colin. *Op. cit.*, p. 151.

PART II.

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FURTHER REMARKS ON THE PERIOD OF INFECTION IN EPIDEMIC DISEASE.

THE starting point for the present investigation is from an "Essay on the periods of Incubation of the Various Morbific Germs", addressed to the Central Board of Health, by George Gregory, M.D., Physician to the Small-pox Hospital, and published during the cholera epidemic of 1832. Besides the high importance which this subject obviously possessed in reference to the sanitary and police regulation of that time, one principal object of the author "was to direct the attention of observing physicians to this neglected branch of pathology". His observations on ague, as well as on small-pox, are of the highest value; I acknowledge my obligation, and wish to place my contributions on the excellent basis afforded by this essay.

A previous communication to the Epidemiological Society on this subject, chiefly deals with the earlier stages of infectious diseases; it is to the latter limit of infection rather than to the incubation period I would now direct attention. The new facts to be brought forward, though not very numerous, are important; they support and define many of the positions already assumed, illustrate the duration of infection in scarlet fever, and supply details of the incubation of diphtheria.

Dr. Gregory's experience at the Small-Pox Hospital afforded abundant evidence that the period of incubation for small-pox was twelve days; or fourteen, "counting", he says, "as I always recommend should be done, from exposure to the *appearance of the eruption*". He moreover establishes the possibility of variation in this period by cases in which the longest interval following upon a single exposure was fifteen days; the shortest under the same condition was twelve days. These cases show for small-pox what appears from my cases to be true for measles, that a single definite exposure is often followed by an irregular incubation period, instead of serving to fix the normal period.

The scope of Dr. Gregory's subject precluded remarks on the duration of personal infection in convalescents. An example of it, however, is seen in his first case of small-pox. Mary Argent was discharged convalescent from the Small-Pox Hospital, July 6, 1830. She slept that night with her sister, Susan Argent, who sickened for the small-pox July 19; the eruption showed itself July 21. Further experience at the hospital has obviated this danger. Mr. Marson informs me that some time ago convalescents from the Small-Pox Hospital were traced to their homes, and inquiries made for two or three weeks after their return, without finding a single instance of the disease having been thus occasioned. Have typhus convalescents been similarly watched, to see if on return to their homes and occupations they had or had not given rise to new cases? I ventured to assert, from a single instance coming under my own observation, that the infection of typhus did not cease so soon after convalescence as had been inferred from the limited sphere of observation in hospitals, where typhus patients make no long stay after their rapid recovery. We have not much typhus now in London to test the question, but in the late epidemic at Carlisle there were examples of this mode of conveyance, and one very clear instance of typhus being conveyed by means of *fomites*. None of these came from the Fever Hospital.

It is not contended that personal infection lingers as long in typhus as in scarlet fever; these two diseases are placed in different categories in this respect; but even if the duration of infection in typhus be comparatively short, its limit is not the less in need of definition.

The incubation period of measles *(morbilli)*, rubeola, varicella, and mumps, as previously demonstrated, follows closely that for small-pox, ten days being the shortest, and fifteen to seventeen the longest time, excepting mumps, where it has extended to three weeks. A further illustration of this, for measles, is given me by Dr. Evans, from St. Thomas' Hospital; a child from a house infected with measles was admitted to the Victoria ward for a burn; ten days afterwards this child has measles and is removed; ten days after this, five children in the ward are ill with measles; in a second outbreak three other of the children sicken on the tenth and twelfth days. Rubeola, so prevalent last summer, has an incubation period closely corresponding to, but somewhat in excess of, that for measles. This, in my first published case, is proved by all subsequent experience to be not less than twelve days, viz., from November 16th to 28th, a correction required at p. 25 of the previous paper; the interval has in all cases exceeded ten days. Some of the later cases show an interval of seventeen, and, possibly, of twenty-one days. The long time of incubation distinguishes this rose rash broadly and absolutely from scarlet fever; it is also a cause of the source of the exanthem being so often overlooked and the eruption attributed to cold, heat, fatigue, or food, instead of to the infection on which this form of rubeola (rötheln), often confused with *Roseola æstiva*, is always dependent.

For diseases of a long incubation, as typhus, typhoid, small-pox, chicken-pox, measles, and mumps, infection would seem not to continue long after the special morbid process of each disease is completed. Three weeks from the height of the eruption in small-pox and measles suffice for the cessation of personal infection, allowance being made for delay from complications; care is also requisite that no effete remnant of a morbid action already over, clinging to the skin or to articles of clothing, should convey a disease from which the convalescent is free.* Exception may be made to the short period assigned for the termination of infection in these diseases, but there is proof of this being near the usual limit. For small-pox we have the fact that within that time the crusts have separated, and evidence that after this is completed the risk of infection is over.

Very different is the teaching conveyed by the results obtained in the investigation of the group of diseases characterised by a short period of incubation. The old *quarantaine, i.e.*, forty days, or six weeks of isolation for those who had been infected with plague, represents very nearly the time necessary for the strictest caution to be observed after whooping cough, diphtheria, and scarlet fever, in guarding against the spread of these diseases. The six weeks should be reckoned always from the height of the disease, and in scarlet fever, where the earliest symptoms are the most obvious, a longer interval must be allowed.

In whooping cough, precautions should always be taken for six weeks from the commencement of the whoop, and though in some complications the time may have to be extended, it seemed sufficient in the following case for all infection to have ceased :—A boy at school has whooping cough from July 16, the whoop well marked on the 21st;

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* I have known measles conveyed to another house, somehow, by a child two months convalescent.

febrile disturbance continued to the second week in August, when the expectoration was free and the appetite returned; he now had change of air, and improved rapidly. On September 5, the family reassembled at home without any bad results. On October 20, this boy has a bad cold, with spasmodic cough, and much viscid secretion; a younger brother, now with him at school, has a cold and cough on November 4, but neither he nor others with him have whooping cough. Infection may persist for two months.

This relapse of symptoms in whooping cough may occur, as is well known, for months, and certainly after all infection is over. In diphtheria, it is possible that some of the later relapses may be without infection. We have lately had cases brought before us by our member, Dr. Ransome, where exudation constantly reappeared up to six and eight weeks, and in prolonged disease infection is most likely prolonged also. The persistence of personal infection for from four to six weeks is abundantly proved: the little girl who took diphtheria on joining her convalescent sisters at the seaside had been separated six weeks. In two of Sir William Jenner's cases infection seems to have been particularly active in the fourth and fifth week.

Possibly in some of these diseases, most probably in scarlet fever, infection is given off more at a certain advanced stage of convalescence than in some earlier part of it; when all the functions are more nearly restored to their healthy standard, they may expel the last products of the disease with more activity than when they were in a languid or debilitated condition. For scarlet fever, it has been shown by the two cases in the previous paper (p. 38), how convalescents may communicate infection nine weeks after the commencement of the disease; in the second case it seemed as if the infection was more active at the end of this long period than at an earlier part of it. For another instance of this I am indebted to my friend Mr. Tweed, of Upper Brook Street:—A lad, aged 14 years, has scarlet fever in the summer in a mild form at school, where he goes through the illness with others. After a month he comes home to his family in London, but at first is kept as much apart as possible. A fortnight after his return, two sisters, aged 17 and 19 years, spend a week with him, and then go on a visit to the country. They remain away ten days, and again return home to their brother; on the day week of their return both have scarlet fever; the symptoms were mild, but well marked throughout, so as to leave no doubt as to their nature. No other source of infection is discoverable beyond this return home to their brother, sixty days after the commencement of his illness. This period was exceeded in the other cases given, but here we remark the infection was inoperative during a previous fortnight. May it be that some infection given off by the brother accumulated in the house, and that the sisters returned to it from the country in a higher state of susceptibility? One of our members, Dr. Elliot, of Carlisle, attests the accuracy of the following facts published by the gentleman in whose family the cases occurred.*

Four years ago a boy from school, convalescent from mild scarlet fever, is sent away a fortnight after his recovery, with one of his brothers as a companion; in six days this one is ill with the disease. Six weeks and a day after this, all desquamation having ceased in the younger one, and both being dressed throughout in new clothes, they return home; again in six days from their return two younger children simultaneously begin with the disease. In watching these two patients most carefully, desquamation was traceable in the mildest of the two cases up to the eighth week; at the end of the ninth week they joined the rest of the family, and no further evil consequences ensued.

More importance is generally attributed to desquamation in the spread of scarlet fever than is its due. As a visible sign concurrent with others less obvious, it is useful in showing that the reparative processes are incomplete, and in directing attention to the skin, to warmth and cleanliness, but a perfectly innocuous cutaneous epithelium may be separating, while from another surface an actively infecting product is being set free. Perhaps the evil resulting from this erroneous view more than compensates for the good, for by directing attention exclusively to the "peeling", which, often active in the second week, may be nearly over in the third, persons are deluded into the idea that infection is then over also, and the disease be again allowed to spread.

The numerous instances of infection in the latter stages of scarlet fever, and the success which usually follows early separation of the healthy from the sick in saving them from the disease, have originated an idea that scarlet fever might possibly not give off infectious particles or germs until arriving at a certain maturity; consequently, that the first stages of the disease might be harmless. A striking example of the influence of this belief occurred last November at the Epsom Petty Sessions, where a person escaped penalty for removing a scarlet fever patient in a hired fly, by obtaining direct medical testimony that the disease was not contagious in its early stages. That this is an error is clearly shown by cases 7 and 8 (p. 443) in the former paper, where of two children one only is exposed to scarlet fever on February 17th, has rash on February 20th, and communicates it so rapidly to the other that the symptoms of it appear the very next day. Another instance of scarlet fever being communicable on the first day of illness is the following. In a family of nine children, the eldest comes home from a school in which was scarlet fever. Three days after, the mother, in delicate health, is suddenly seized in the night with illness, and the next morning has the rash of scarlet fever. The eldest of the family has already gone away, and the two youngest children are now sent off with the nurse; three elder girls, who had been into their mother's room on the morning of her illness, go to the house of an aunt near; three of the children remain in the house. On the third day two of these are taken ill; on the fifth day, five days after the separation, one of the girls is sent home with scarlet fever; two days after, a servant and the only other child in the house are seized. The two youngest die. The five children who had been separated join the convalescents at the sea side, six weeks and three days after the last seizure, without injury.

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* "On the Necessity of Perfect and Prolonged Isolation for Stamping Out Contagious and Infectious Diseases." Steel Brothers, Carlisle. 1874.

The two first of the following cases occurred ten years earlier in houses well situated, but with old brick drains remaining in the basements. The eldest girl of a family of five young children, sleeping apart from them in her mother's room is seized in the night with an illness which next morning is thought to be scarlet fever; that day none of the other children come into the room; lodgings are taken for them in a house opposite the same day. They are sent there with their clothes and all that they want, and no communication is said to take place between the houses; the day fortnight after the removal of the four children, the eldest of them, a girl, is sent home with fever and commencing rash; the three younger, boys, continue well. A month from this time, six weeks from the first illness, the second case being mild and both considered convalescent, all the family meet at Brighton. Again, at the end of a fortnight the disease re-appears; the second boy, aged two years becomes ill; three weeks after the youngest, nine months old, takes it; lastly, the eldest boy, who had not been kept apart during the stay at Brighton, sickens when his brothers have recovered, the scarlet fever running a mild course. These attacks occurred from July to October, keeping up an anxiety during three months which another three weeks of isolation in the first instance would have obviated.

In the first of these groups of cases we see that personal infection had ceased in six weeks from the illness; we cannot always be sure it is over so soon. We see in the second group that to allow a less period is to let the disease be again spread in a way that is most frequent. In the first group, all who remain in the house take the disease; in both, one of the children removed has it, but on again separating the affected child, all the others escape: the long interval in the second is exceptional, yet any conveyance of infection from the house opposite was not traced. In the first case the disease appeared within six days after separation, an interval corresponding with the usual limit. In the only instance under my own observation, where the symptoms have appeared as late as the eighth day after separation, there had been communication with the infected household during the interval. It is a point of the greatest practical importance that, on removing the healthy from a source of scarlet fever, one week will generally suffice to determine their immunity. Yet I have known children kept from school three weeks, because they had visited at a house where scarlet fever broke out after they had left.

For diphtheria, to determine whether infection has been escaped, a somewhat longer separation is prudent than is required for scarlet fever. An eight days' interval for incubation is proved in Mr. Adams' case, where prompt removal was effected. Details of a similar case will be given, wherein it is not perfectly clear that the interval was only eight days. Abundant evidence of the shortness of the incubation period for diphtheria exists. We know from Sir William Jenner's case in the Children's Hospital, where the disease was found to be in an advanced stage within thirty hours, that the hours of the latent stage may be numbered by units. The two cases published by the author, in the "System of Medicine", article "Diphtheria", show that the shortest period of incubation could not have been less than three days in the first case, nor the longest period more than four days in the second. But single instances do not seem to fix either the longest or shortest possible periods for diseases so variable in intensity and duration as are scarlatina and diphtheria. The following is an example of the long interval :—In the family of a doctor of medicine, living near the southern boundary of the Fens, a housemaid is ill with sore throat and slightly marked febrile symptoms on July 17, 1874; on July 23 the elder of his two children goes to visit a relative at a perfectly healthy house, well situated on the chalk, in Hertfordshire. On July 30, this child, who had been very lively and well till bed time, becomes suddenly febrile, with vomiting, high pyrexia, and next day enlarged cervical glands; exudation soon appeared on the tonsil and fauces, and persisted for ten days. The child at home was taken ill in the same manner on the same day. Subsequently two other residents in that house were ill, the one with severe, the other with slight sore throat. The possibility of a more than eight days' interval is suggested by these cases; but until some clear evidence of a longer interval is forthcoming we must leave this as a limit, or allow ten days at most for it.

One reason why the duration of the incubation period for diphtheria has been unduly prolonged is because the special exudation cannot sometimes be depended on as characteristic until the third day of the disease; it often does not excite attention till a day or two later; consequently, when the source of infection is known, the interval from exposure is reckoned up to this advanced stage of the illness. A second reason is, that very often the whole time from the commencement of a continuous exposure is reckoned, though the infection may only have been received in the latter part of it. This consideration affects the cases contributed by Dr. Rumsey to the second report of the Medical Officer to H.M. Privy Council. In these cases, one sister takes the complaint exactly a fortnight after the other was seized with it. But they had been together during the illness, the second taking part in the nursing of the first. The first sister also was seized exactly a fortnight after the return home of a brother convalescent from diphtheria, but infection might have been imparted on any day after the first of his return. In diphtheria, as in scarlet fever, infection may be more active at certain stages of convalescence than at others. This appears in some cases given by Dr. Johnson in "The Lancet," January 2, 1875. A girl, aged 17 years, who had been ill ten days before at school, returns to a healthy country house where are seven younger children; all keep well for a fortnight, when, the elder girl being freer from all signs of illness than on her first return, two of the children take diphtheria and die; the others, separated as soon as these were seized, all escape; yet they had been already exposed for a fortnight to infection from the elder sister.

In the same article some very instructive cases, observed by Dr. Carey, of Windsor, are given. In a family of nine children, two, and the mother, are ill with diphtheria; the mother dies: this is in December. Five of the children are then sent away; the two convalescents and two others remain at home. Of these, the youngest child is seized January 15, and dies on the 23rd; the three remaining now leave the house, which is thoroughly cleaned. The family does not return till April 9. On April 16 a gentleman visits at the house, staying that night and the next. He feels ill on the evening of the day he left; next day he has sore throat, and on the third day diphtheritic exudation. Hence this case might by some be reckoned as of four days incubation, instead of one, or less than two at the longest. A more important correction is required in the last of these cases. On April 23 the whole family again leaves the house. Of two children who go together to a healthy farmhouse, one becomes ill on April 25, or within the usual time for the infection of diphtheria showing itself. On May 11 the other child sickens; but instead of supposing the infection in this case to have been received eighteen days before, and taking this as a proof that it came directly from the infected house, it is easier to believe that the illness of the second child was derived from that of the one then going through the disease under the same roof. These cases require noticing at length, as they are used to support the view of local causes being in themselves sufficient to originate diphtheria. The first link in their causation, as is so often the case, eludes us; but the persistence and fatality of the outbreak can be traced to the existence of a foul disused cesspit under the floor of the infected house. It is argued, from the fact of this cesspool being disused, that infected matters from the sick did not directly enter it and so become a source of re-infection; but it must be conceded that if the air of the cesspool could get into the house and infect the inmates, the air of the house bearing infectious particles could get into the cesspool; indeed, with the alternations of moisture, pressure, day and night temperature, house fires, and other causes, this interchange must be constantly going on.

The relation to local sanitary defects of diphtheria would seem to be somewhere intermediate to that of typhoid and scarlet fever, less constant and definite than the one, somewhat closer than the other; like scarlet fever, often intensified by the association, yet much influenced by individual susceptibility and not independent of infection, as seen in the following cases:—On January 8th, 1871, a woman, aged forty-six years, returns home to a perfectly healthy house at the west end of London, after nursing a child who died of diphtheria at Teddington the previous day. On January 9th, the nurse has stiff neck and fever; next day, exudation on the uvula and right tonsil, albuminuria, temperature 104·5 deg. Her son, aged seven years, is removed to another part of the house; a grown-up daughter remains to attend in the sick room. Four days afterwards, in the night of January 14th, the boy is sick, and on January 15th, has sore throat, enlarged cervical glands, high temperature, but no rash. In the night of the 15th, the daughter has chills and complains of her throat, next day is febrile, and the day after has exudation on the right tonsil. The fever lasts five days, but is not severe, the skin being pale and moist; both she and her mother had previously had scarlet fever. The brother had a prolonged and serious illness, which during the whole time it was impossible to say was not scarlet fever; there was albuminuria from the second week to the sixth, with anasarca, and hæmaturia at the month end. The pyrexia lasted a fortnight; twice in the course of the illness some irregular rash was noticed; he had never had scarlet fever. One such instance of this ætiological relation of scarlet fever to diphtheria gives great support to the idea of their essential identity: some facts from morbid anatomy point to a close relationship between diphtheria and croup; were we, in consequence, disposed to assume that these two diseases are really identical, the difficulty of admitting the identity of croup and scarlet fever would be an insuperable obstacle.

On investigating the source of these attacks at Teddington, it was evident that the child who died had diphtheria, and not scarlet fever; three other young children were in the house who, not having had the disease, did not then take it, nor was it epidemic near. The sanitary defects at first sight were glaring; ten houses built on alluvial gravel, near together, had no drainage; in the back yards were open privies. The interior of the house was clean and commodious, and this child, the youngest, never went to the out-door privy; in fact no connection could be established between the local conditions and the occurrence of diphtheria, but this: the grandmother, aged ninety-three, on returning from the back yard, on December 8th, the weather being cold, was seized with illness, and had sore throat; afterwards the mouth showed many white patches, and the breath was offensive. All this had cleared off, and beyond debility, the old lady was feeling pretty well again, when her grandchildren came to visit her in her room in the last week of the year. She had the youngest on the bed to kiss; the child was taken ill on Sunday, January 1st, and died on the 7th of January, with great cervical swelling but without laryngeal symptoms. The depressing effect of cold probably was more concerned in predisposing this aged woman to diphtheria than anything from the foul privy, though the exciting cause may have arisen there. No other inmates of these houses suffered.

The close relationship between scarlet fever and diphtheria is a matter of common knowledge; the same precautions necessary against the one are required against the other; they agree in the circumstances that either aid their favourable progress or are hurtful to it. The precaution necessary to prevent the unintentional spread of these diseases by sending persons among the healthy from a source of infection is that, not only should the full week requisite for scarlet fever elapse, but a period somewhat in excess of this; for while, as in scarlet fever, diphtheria will generally show itself, if it be taken, in three or four days, much clearer instances of it happening after a full week's separation are forthcoming than in the case of scarlet fever.

Scarlet fever affords a strong contrast to measles in all its characters; the interval from exposure to sickening is usually short, and the rash is always an early symptom, so that it ought not to be difficult to separate the sick from the healthy with good prospect of success; and, as a matter of experience, early separation is found generally successful. Moreover, there is this in favour of such a course, that if any of those removed have really received the infection, symptoms of it will appear so soon, that no long uncertainty has to be provided against, and a second separation is sure to be timely.

It is well to state more formally this difference between scarlet fever and measles: on separating children from a short, definite exposure to measles, no distinctive illness is to be expected until after more than a week's interval, and they are not safe to escape for a fortnight: on separating persons exposed to the infection of scarlet fever a few days, it may be three to five, sometimes a few hours will suffice for the disease to appear: after a week of immunity, we may be satisfied that the disease has been escaped. The utter divergence from, and dissimilarity of measles to scarlet fever cannot be too forcibly insisted on; these two diseases are representatives of wholly different classes of disease, measles bearing affinities with small-pox, chicken-pox, mumps; scarlet fever with plague, erysipelas, influenza, diarrhœa, perhaps also with cholera. No vestige of place for doubt remains as to the close relation of rötheln, the rash to which much attention has recently been called, to measles and not to scarlatina; so the relation to dengue, a rash common in Africa and both the Indies, is clearly and closely to scarlet fever. I doubt if it have more than an accidental resemblance to measles. To speak of any new or anomalous rash as a hybrid between measles and scarlet fever is a confusion of terms and ideas, destructive of what we know, and obstructive of further knowledge.

A popular recognition of these differences is of the utmost importance to the safe management of the sick, and especially to the safety of others. For instance, is the finely diffused rash of scarlet fever the early symptom? Then separate, if possible, others of the family: but, supposing the isolated spots or groups of spots of measles appear, doubtless the previous sneezing or coughing will not have been overlooked, and it is too late to separate others, or at least it is wrong to send them among the healthy susceptible. Again, after the rash of measles is fully out, one day suffices for the child to eat and drink and sit up; care against chill and fatigue is wanted, but the illness has suddenly declined with the throwing out of the rash. In scarlet fever the rash is only the commencement of a series of special injuries to which most organs of the body are liable for a period of three weeks, against which rest in bed for all this time is the best prophylactic; after this the special accidents of convalescence are to be feared for another three weeks. Albuminuria and the dropsy which result after scarlet fever are unknown in or after measles. Measles seldom or never recurs; scarlet fever not unfrequently happens more than once.

An important practical deduction from these facts which, if acted upon, would soon reduce the spread of scarlet fever to a minimum, and relieve our healthy sea-side towns from one of their greatest risks, is—do not seek change of air too soon for scarlet fever convalescents: they are better in their rooms for the first three weeks; they are not only safer in their homes for the next three weeks after that, but they gain strength just as fast, often faster, than if they had been sent off for change of air, to the danger of the conveyances used; to the danger of the lodgings they go to; and to the danger of all with whom they come in contact. This is of special importance in the management of schools. Much may be done by domestic management in keeping convalescents not only from school, but from play, theatres, parties, and fêtes, until reasonable fear of infection is over. School managers have a duty to protect their schools, they should have power, so as to be able to exclude from school those known to be likely to bring infection with them. It need not be difficult to obtain a written statement of the illness a child is absent for; then let it be incumbent on the manager not to receive that child for six weeks at least after an attack of scarlet fever.

For the nearer allies of each of the diseases already treated of, some variation is noticed from the typical characters just given. Chicken-pox follows small-pox so far as for the sickening to occur twelve days after exposure to infection; but, instead of the rash beginning two days afterwards, it begins at once; and some isolated spot may always be detected as soon as the first symptoms of sickness are felt. There is no more trustworthy guide to so important a matter as the distinguishing off-hand whether it be chicken-pox or small-pox that may have appeared in a family or institution, than to ascertain whether the first spots were preceded by illness or not. I have known chicken-pox to be attended with so much fever, and the spots of so suspicious an aspect, that, but for this circumstance, a fear of small-pox would have remained; also, and this is of greater practical moment, I have known small-pox so masked and modified, that but for the two days of back-ache and malaise preceding the eruption, some of the necessary precautions against so insidious a danger might have been omitted.

There is the same parallel noticeable in the relation of measles and rubeola (rötheln); in the latter the eruption occurs without precedent illness, or with some faintness or catarrh of only one day's existence, instead of three or four.

An allied exanthem, marked by a diffused form of rash, not unfrequently met with in the summer, may be termed *epidemic roseola.* It is quite distinct from rubeola or rötheln, though hitherto not clearly separated from it, and some confusion has entered into the descriptions given of either from want of attention to their distinguishing characteristics. Bateman's description (*op. cit.*, p. 96), applies to the latter; the former may be included in one of his first varieties. Both are readily discriminated from the rose-rashes produced by irritating matters taken into the stomach, as with them the illness follows quickly upon the exciting causes, be they food or physic. Roseola differs from rubeola in aspect, for it does not begin in isolated spots, but a finely diffused redness is noticeable first in the face and neck soon after slight faintness or giddiness has been felt. The small lymphatic glands of the neck are palpably enlarged in both ailments, and there is soreness of the throat. Fuller, in his "Exanthematologia", p. 128, speaks of this sort of rose rash, "as a flushing all over the body, like fine crimson, which is void of danger". This rash may be followed by desquamation, which, rare in measles, is still rarer after rubeola.

Roseola agrees with the scarlatina group in having an incubation of near upon a week; another strong affinity is shown to this class of disease by the occasional occurrence of albuminuria, a point contrasting strongly with the measles group in which albuminuria is not known to occur. I have met with one statement, that albumen has been found in rötheln or rubeola; I suspect here the rash was of the diffused type I wish to discriminate, for I have examined for myself very many cases of rubeola without ever finding albuminuria, but in a less numerous series of this kind it has sometimes been present. The interest attaching to this consideration is very great, for seeing the close connection of rötheln with measles, roseola, as here defined, might turn out to be some derivative of scarlet fever; the more prevalent scarlet fever is, the more does this prevail. Long ago the connection of roseola with summer diarrhœa was noticed by Bateman; the interchange of summer diarrhœa and winter cough is very constant, and has frequently been set forth as closely correspondent. These ailments may seem slight and of no great moment to the strong, but they are serious to the weak, and are the great causes of infantile mortality, especially in great towns.

Albuminuria has been met with in the early stages of this diffused form of exanthem, even where the febrile disturbance has been slight; muscular and articular pains have followed some of the more marked cases.*

The infection of catarrh, and of sore throat under its two distinct forms, the follicular and parenchymatous, with the relation to influenza, alluded to in my former paper at p. 444, may be illustrated by a few cases. On December 11th a little girl comes home from school with bronchial catarrh, and sleeps in the same room with a sister, four years old; it was noticed at night how quick was the breathing of the elder girl, and how quiet that of the other. The next morning, by 7 a.m., the younger child is breathing rapidly, has coryza and fever by evening, on the second day catarrh, on the third congestion of the lung, and a six days' illness. Two other children of this family on December 13th and 14th were similarly attacked. The same winter, in another nursery, an elder child introduces catarrh on December 8th; on December 10th the younger sister, two years old, has a similar cough; on December 13th a boy three and a half years old becomes suddenly febrile and has a bronchial attack lasting six days. In both these nurseries the under nurses were seized, during the week they were in attendance upon these children, with follicular tonsillitis, coming on with intense aching of the back and limbs, and resulting in the formation of several small ulcers on the tonsils in the one girl, and a larger round ulcer of one tonsil in the other. The febrile period did not exceed three days. This form of catarrh is often epidemic, it has a short incubation period, and is associated with influenza; it begins with elevation of temperature, often subsiding on the third day; there is generally some enlargement of the lymphatic glands in the neck. I once found the mother, while in close attendance on a child dying with laryngeal croup, suffering this form of follicular tonsillitis.

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* I may add some recent details: on May 8th, 1875, a little girl of two years old felt tired and was restless at night; on the 9th a fine bright redness was noticed in large patches on the back, chest, and neck; a vivid patch encircled one wrist. The redness became more diffused at night, the temperature was not quite 100 deg. The next day the redness was fading, and the temperature normal; the small cervical glands were palpable, there was no sore throat, but some mucus four days after. Other children in the family had no rash. In another house, on June 16th, a maid-servant, aged fifteen years, in regular health, felt giddy while dressing, and vomited; a fine rash was discernable over chest, neck, and arms; face very red, eyes suffused, pulse 100, temperature 99·2 deg.; 17th, rash fading, tongue clean, slight redness of palate and fauces, slight fulness of tonsil just visible, one small gland felt at angle of jaw. Pulse 80, temperature 99·6 deg., albuminuria. 18th, feels well, albumen much increased, it lasted a week. On the 24th, the lady on whom she attended felt faint, and was sick at noon; suffusion of face by evening; the rash faded next day, but she had aching of the limbs and restless nights. On May 29th, two young married people came from different parts of the country to attend an evening reception at the Foreign Office; on the 31st, the lady has a fine rash on the chest, neck, and arms, with no rise of temperature; next day in bed with more rash, temperature 99·6 deg. The gentleman complained of sore throat, and next day is covered with finely diffused red rash; he kept in doors, but not in bed, and the temperature rose to 101 deg. Afterwards severe pain in the limbs, and loss of sleep. These two cases, though they had not previously had scarlatina, and did not communicate it to young children in the house, very much resemble some cases of modified scarlatina, transmitted by milk or cream, during the same season in London. The others were simply roseola, as my second published case of scarlatina ("Temperature Observations," p. 18) proved to be, for the child afterwards took scarlet fever.

The parenchymatous form of tonsillitis is associated with conditions more limited in their operation, whether individual or local; the two forms are seldom met with together, and rarely pass the one into the other; when transmitted by infection the latter inclines to the longer period of incubation, extending from two to six days. Last spring, in a good country house with but one sanitary defect—that of an indoor water-closet connected with a closed receptacle, which had not been recently emptied—a boy, aged eight years, has fever and sore throat on March 10th; there was dysphagia for a week. No sooner is this boy convalescent than his mother, who nursed him, suffers with sore throat and great prostration on the 25th; her illness lasted a fortnight. On the 2nd of April a youth in weak health comes to the house, he is seized on the 8th with sore throat and fever. The illness lasted ten days, though during his illness the defect in the water-closet was remedied. The patient left his room on the 18th, and went out of doors on the 20th. On the 22nd he visited a family living at an isolated house two miles off; on the 24th a servant there complained of her throat, and is ill on the 25th with quinsy. At the same time, a servant at the first house has quinsy. Two children of different families visiting at the second house have sore throats on the 26th and 27th; another child then with them soon suffers, and each of these three children, two in different parts of the country, and one on returning to London, become centres from which other attacks proceeded. Stomatitis in the young is communicable by infection, and is more closely related to this than to the catarrhal form of inflammation. I have notes of the visit of a healthy girl, five years old, on March 23rd, to a house near London, where the children had this complaint.

The little girl returned home on March 25th; on the 27th she became ill, next day small ulcers appeared in the mouth similar to those in the other children, and the lymphatic glands were enlarged for some days longer.

Relapsing fever has now been produced by inoculation, the incubation being five days. It is only during the presence of *spirillæ* in the blood that it is infective.

Plague, on its re-appearance last year, was studied at Benghazi by Dr. Laval, Surgeon-Major of the French army in Algeria, at the cost of his life. The incubation period was from two to four days; the attacks were sudden, with high fever in the first few days, the temperature soon reaching 102 or 104°, the pulse 100 to 130 or more; the glandular swellings began on the first day.* Dr. Augustus Bozzi Granville, in his "Autobiography" (London, 1874, p. 137), describes how on reaching Constantinople, many years ago, landing at Tophaneh in the forenoon, he awoke with tremor and headache in the course of the very first night, the swelled glands characteristic of plague appeared in the axilla on the morning of the third day, the fever and delirium left on the morning of the seventh day. He was convalescent in a fortnight; he also relates the self-inoculation of Dr. Valli, who had not been in the Plague hospital three days before he contracted the disease.

Yellow fever has recently been most accurately observed in America, especially by Drs. J. C. Faget, and J. Jones, of New Orleans, and by Dr. Sternberg, of the United States army. The temperature-curves of 183 cases show a single paroxysm, highest at the outset of the disease (103 to 105° or more), rarely extending to the third day; the pulse falls before the temperature, and sometimes becomes slow, one attack in the vast majority of cases protects from a second. The incubation period was mostly close upon five days, often considerably less; there are exceptional cases of eight days, but the danger of infection attaches more to places and things than to personal transmission.

Dengue has been proved thermometrically, in the epidemic of 1873, to have a very sudden ingress, a remission on the third day, and one exacerbation on the fourth day ; the temperature elevation, both of the ingress and the culmination, is from 102 to 103° ; the variations of the pulse exactly correspond with those of the temperature ; there is swelling of the lymphatic glands. Sudden faintness, vomiting, chill and high temperature precede the rash by a few hours only; some fine desquamation follows ; relapses are not infrequent, and infection lingers for two months. Persons who, in my own knowledge, have had measles, are not protected against attacks of dengue. The liability to recurrence in this disease enables me to agree with Dr. Seguin, of New York (to whose courtesy I am indebted for these new facts) in considering dengue a malarial epidemic ; he thinks it may take its place "with intermittent, remittent and hay fever, influenza, true pneumonia, etc., a group which will grow larger as our knowledge of ætiology will enlarge."*

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* This feature is noted by Surgeon-major W. H. Colvill, in his report to the British Consul, at Bagdad, on Plague in Mesopotamia, in 1875. Glandular tenderness sometimes began with the fever; enlargement of the glands was noticed before the fever in one case, in this the temperature was 100 deg. on the fourth day; some of the temperatures taken evidently denote collapse. A very clear instance of incubation not exceeding forty-eight hours is given by Dr. Colvill, proving the disease not to be marsh fever.

Cholera incubation lasts from a few hours to four days ; the premonitory diarrhœa, properly a part of the disease, a few days only. The detection of albuminuria by Dr. Schlimmel,† several hours before other symptoms of cholera appear, tends to limit more closely the period of incubation.

I am permitted by one of our members, now present, to record these facts as they befel in his own family :—In 1853 three gentlemen from different parts of Kent met in London, and dined at the Nag's Head, in the Borough, on Friday, October 21st, the landlord's wife being then ill with choleraic diarrhœa. The elder of the three, who passed the night in the hotel, returned home on Saturday, was seized with cholera the same night, or morning of the 23rd; he died on October 27th ; next day, the 28th, his wife, who nursed him, was seized, and died on the 31st. A friend, who came to the house on the 27th, staying only a few hours, but visiting the patient, was attacked on the 30th, within sixty hours of entering the house, dying on the same day. An old man-servant, well on the 30th, was seized with cholera on the 31st, and died the next day. Of the two younger men, returning to their homes on the Friday and Saturday, one became sick before he reached home, the other was taken ill at 7 a.m. on the following day, and had a serious illness; both recovered. There was no extension of the disease from any of these houses.

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* "Medical Thermometry and Human Temperature", by E. Seguin, M.D., New York, 1876, p. 143. From this perfect store of information, received while correcting this sheet for the press, I extract—" DENGUE (Syn. *dandy fever, break-bone*, etc.) Apparently a purely eruptive, epidemic disease of the warm climates. By its eruption often mixed with other epidemics due to summer heat; looks like measles or scarlatina by its eruption ; by its pains and swellings of the joints, like rheumatism ; by its glandular symptoms like typhus ; by its mode of invasion, like yellow fever, by its initial chill, like intermittent, and by its periods like remittent. Thermometry takes it out from that hybrid status, and sets it up as a malarial entity which has its own thermonomy, viz. : invasion too sudden to be noted previously to its acme. Two paroxysms separated by a short remission, and lasting from five full days to seven short."

† " Du Présage et de l'avortement de l'imminence Cholérique." Rotterdam, 1874, p. 32.

An outbreak of cholera in Normandy has this history:—In 1848 a fishing lugger, l'Étoile of Fécamp, had to put in to Dunkerque, when cholera was there, leaving on November 9th, and arrived on the 10th at Fécamp with three of the crew ill of cholera, one was taken to the hospital, two to friends in Ypport; the youngest, a lad already algide, was placed in his mother's bed beside her; she was seized next day, and died in twenty-four hours; a few days after a young sister was taken ill and died rapidly. The disease then spread to the houses near, and soon to the whole village.

Kennedy, in "The History of Contagious Cholera" (London: 1832), says the first fatal case in England, that of Robert Henry, a Sunderland pilot, began August 1831, the day after he had piloted a foreign vessel that had come from an infected port of the Baltic. The conveyance of cholera from Newcastle to Gateshead, separated only by the Tyne, is traced to a Mrs. Hindmarsh, who visited an infected district of Newcastle on December 14th. "About eleven o'clock of that night she was seized herself with symptoms of cholera, and on Thursday, the day ensuing, she died." On the 18th the husband goes to lodge with his brother-in-law and two sons in a healthy part of the town; he has some diarrhœa at the time, and takes a chest of clothes with him. On the 26th, one of the sons in this house is attacked, and on the same day the father, and also a second son, who left home the day before to commence work at Shields, all died; the first on the evening of the 26th, the father on the 27th, and the second son at Shields on the 28th of December. The mistress of the house at Shields, where this young man died, was taken ill four days afterwards, and died the next day of cholera.

In these, as in many other instances, very sudden effects follow on first exposure to infection of great intensity, while in some subsequent seizures an interval of three or four days is found. Hence an inference, supported by some in-conclusive experiments, that the infecting particles might undergo some change of state, after being thrown off from the body of the sick person and before entering that of the recipient, analagous to what we suppose for the period of latency within the body. The fresh ejecta of cholera patients are not strongly infective, they become so after decomposition; whether this sets free the infecting particles, or whether they are increased by special fermentation is uncertain. Such special augmentation in hot climates would seem a necessary assumption for yellow fever. Any possible increase in the intensity or quantity of infection in this way would probably be restricted within narrow limits that might come within the scope of the present inquiry. There is, however, another possible development of infecting material quite different to anything here treated of; alternating with outbursts of epidemic energy are times and seasons of quiescence for infective germs. We know how for long periods infection may be restrained from action, as that of vaccinia in glass tubes, and we can understand how it may again become active. I would withhold the term of *incubation* from these uncertain periods, and using the term *dormant* for certain conditions under which infection may remain inactive, restrict the use of incubation to the development of disease within the body, and the terms *latency* and *invasion* to the two stages of incubation.

Hydrophobia and ague point to the possibility of infection lying dormant for an uncertain time within the body. Dr. Gregory gives, in his essay, a case of nine month's interval in each of these two diseases. He tabulates thirty-one cases of hydrophobia, and says, "From this table it appears that the average period of incubation is forty-five days; the minimum twenty-one days; the maximum, nine months". Some instances of a longer interval are on record. It is of more importance to direct attention to one or two cases which show the disease may appear in less than three weeks. Dr. Fletcher of Broxbourne, has just informed me of a boy bitten on the morning of April the 1st, who first noticed a difficulty in drinking on April 18th; he saw him with slight choking spasms on the 19th; on the 20th the patient was removed to the Hertford Infirmary, where he died on the same day. The shortest time for incubation of hydrophobia that I have seen published was a fortnight. The more usual period is from four to six weeks.

SANITARY PRECAUTIONS

AGAINST THE

INFECTIOUS ERUPTIVE DISEASES.

THE group of eruptive diseases I wish to consider is more than co-extensive with that of the *exanthemata;* it touches upon diphtheria and influenza, includes typhus and enteric fever, but excludes all the *enthetic* and *parasitic* diseases which are attended with distinctive skin eruptions. Small-pox, measles, and scarlet fever, with their nearer allies varicella, rubeola, and roseola, will be chiefly inquired into, with the object of seeing how far our usual conduct with respect to these diseases is in accordance with the known laws of their existence and extension, as set forth by well-ascertained facts in their natural history.

Precautionary measures, founded on common care and common knowledge, will receive an equal attention with the higher forms of social action embodied in preventive legislation and quarantine regulations; because it is only so far as these edicts give expression both to scientific truth and popular conviction that they can be effectively carried out, and become permanently useful; while the common truths on which they are founded, and without which they could not be enforced, lie at the root of all social sanitary action, from particular cleanliness to the most wide-reaching philanthropy.

Among the scientific truths that need to become common before our sanitary precautions can be made effective against the special diseases it is our duty to prevent, are, first, those medical facts that serve to define the special diseases to be contended against; and, second, the etiological facts which tell us how long a disease will be in showing itself in any person exposed to the risk of taking it, and how long before such person may be considered to have escaped it; or, after taking it, how long it will last, and how long it will be before the risk of giving it to others is over.

The first series of medical facts is not so abstruse or difficult as to be excluded from common knowledge; indeed, it is so much part of it that few are ignorant of the common signs of the eruptive diseases already enumerated, and, except for special measures of guarding against error, few words on this part of the subject from me will suffice. On the second series of questions, if much remains unsettled, much that is perfectly well ascertained requires to be more generally known; ignorance of common facts of this kind still causes pitiable accidents in the smaller social circles, and serious mistakes in general legislation.

Among legislative bodies it would seem that, admitting infection to have occurred under certain extremes of interval in all sorts of diseases, they struck an average, and arrived at a mean which should represent an interval of safety for all; thus ten days' quarantine would seem to be settled for the Mediterranean, and I believe for many of our own colonies—some compelled to do as others do, some free to do as they like. The chief diseases quarantine rules are framed against are cholera and small-pox, the former generally showing itself in three or four days, the latter always after an interval of fourteen days. Now, fifteen days for one and five for the other give twenty days, the mean of which is ten, the number of days fixed, a period quite useless for the exclusion of small-pox, and altogether unnecessary to guard against cholera. In our own ports last year the system of inspection adopted for ships, and found sufficient for the exclusion of cholera, allowed small-pox, introduced by an emigrant ship, to be carried from one side of the kingdom to the other; that our population escaped the danger thus introduced is owing in great measure to the general protection afforded by vaccination, and partly to the efficient means adopted for isolation of the sick.

It is an important fact, as illustrating a prevalent narrowness of sanitary view, that while many ports on both sides of the world are very rigorous in the measures they adopt for the exclusion of disease as an import, they are very lax in the endeavour to prevent its export; a vessel bearing a suspected source of disease is too often hurried away regardless of where else it may do harm, while vessels are detained for weeks on entering a port lest they should introduce a disease often already established there. This detention is quite right for certain diseases actually existing on board, or even where such have recently occurred and the liability to infection is not over, but similar provision should be made for ships about to leave harbour under the same liability.

Of all the precautions against infection that of isolating the sick stands foremost; it is one which can never be neglected with impunity. Not the harsher material isolation, often roughly attempted by military cordons and lazarettes, but the isolation effected by a sanitary zone of fresh air, cleanliness and care such as is needed by the sufferers themselves, and will prevent their coming in contact with the susceptible till the sickness is really over. In some diseases, such as small-pox and typhus, isolation becomes an imperative duty.

For the care of small-pox, special hospitals are particularly suited, as facts on a large scale show that the disease once established is not intensified by the presence of other cases, however severe, so long as the requisite accommodation for each is provided. Until quite of late we have retrograded in this matter, and the old buildings once commonly known in English towns and villages as the 'pest-houses' disappeared, without being replaced by the new form of fever-wards and special hospitals. Vaccination so far suppressed small-pox that these refuges became vacant; less accommodation of this kind is now needed, or more rarely required, but it is not safe or right to do away with this prime necessity in dealing with infectious diseases.

Unless the first unit of disease be controlled we cannot be sure how far pestilence will extend; circumstances might at any time arise which would make it spread; cold, want, war, famine, or even the temporary predominance of the social errors, which find expression in anti-sanitation societies, might admit most virulent plagues. What this last element may do in again disclosing to us the ravages of small-pox, I will illustrate by some facts from that greatest of modern medical observers, Wunderlich, of Leipsig. In 1868, he tells us, that the number of children vaccinated in Leipsig, a town then of 106,000 inhabitants, was 3,443; in 1869 the number vaccinated was reduced to 1,970, and in 1870 to 1,340. Anti-vaccination leagues, clubs, papers, had so prevailed that one-half the children born at this time were unvaccinated. One reason of this was that, for twenty years, small-pox was almost unknown in Leipsig. But now came the war with France; prisoners were received in Leipsig, and with the French prisoners small-pox. In little more than a year, from the end of 1870, 1,027 persons died of small-pox in Leipsig, or one per cent. of the entire population. Of the deaths, 312 were adults and 715 children; a fatality six times more for children than for adults, instead of being greater in those over fifteen years of age, as it is in partially protected communities. Imagine such a state of things to be arrived at in London, and 30,000 children would be swept off in one year, a massacre more than Herodian, and by a form of death from which the adults who allow it are exempted by the very means of safety which they would deny to these helpless victims.

As an instance of how beneficially legislative enactment may be exercised, when based on common knowledge and scientific precision, I will take the case of typhus fever in our large towns. Typhus was not only known as the scourge of camps, jails, and hospitals, in the last century, but as representing quite recently the most prevalent and fatal kind of plague among us.

Fever suddenly spreading in any community in the early part of this century, from house to house, in a workhouse, or maternity institution, was as generally referable then to typhus, or spotted fever as it was called, as similar visitations now are to scarlet fever. It was enough for any other fever to approach typhus in frequency or severity for it to be called typhoid; or, for any other ailment to assume a serious aspect for it to be said that typhoid symptoms had set in. Now typhus fever is so rare as almost to be unknown among us, and the term typhoid, obsolete as applied to a specific disease, is utterly without meaning as applied to symptoms. The practical benevolence of Howard; the scientific research of Priestley, who discovered oxygen in the air; the common knowledge that air was essential to respiration, and that such cubic space of it is necessary to each human being; all this, combined with the special clinical work of Sir William Jenner, defining with exactness what is typhus, find their expression in the Common Lodging Houses Act of Parliament, by the agency of which, under my own observation in London, the hotbeds of typhus were rooted up so completely and at once, that only at rare intervals, and never for long, has typhus fever reappeared in this part of England.

The way in which the Common Lodging Houses Act of Parliament arrested typhus was by limiting the number of lodgers received in these houses, so that overcrowding was obviated; and, by providing that any room from which a typhus patient had come should be unoccupied until after thorough purification. All the benefit resulting from this would have been impossible, had not the medical facts distinguishing typhus from enteric fever, been carefully elaborated and thoroughly mastered. It was soon seen that the infection of the one was as dependent upon impure air as that of the other has since been shown to be on impure water. Isolation and ventilation diminishes the malignancy of, and prevents altogether the one, just as cleanliness and certain sanitary measures stop the other.

Both typhus and enteric fever, it may here be remarked, are eruptive disorders, the *maculæ* or dark mottling of typhus showing four or five days after sickening, the rose spots of enteric fever appearing still later in the illness; in both fevers there is usually an interval of from ten to twelve days from receiving the infection before the illness results, so that care ought to be exercised for this length of time before receiving into new localities or dwellings those known to have been exposed to the infection of either. The greater intensity of infection possessed by typhus is compensated for in some degree by this disease being sooner over, while in enteric fever the infection probably lasts as long as the diarrhœa; and while instances are rare, but not unknown, of convalescents from typhus carrying infection to distant places, it is to be feared that the seeds of enteric fever are often carried to other localities, not only by convalescents, but by those who, escaping themselves with slight symptoms only, yet are media for starting the complaint elsewhere. A precaution is necessary in the commencement of typhus, lest it should be mistaken for measles and so chance to spread; this will receive notice at the end: against the spread of enteric fever, even while other signs of the disease may be undecided, any diarrhœa should be met by disinfectants.

At the commencement of what I have to say of the more ordinary eruptive diseases, I would draw attention to those facts by which they are distinguished from each other, and which must be borne in mind during every intelligent effort for opposing them. Until the practice of inoculation for small-pox in the earlier part of the last century, no one supposed that it would take nine days to produce the disease in that way, and it was much later before the interval from infection was found to be fourteen days; indeed, until facts were collected by the late Dr. Gregory, the constancy of this interval could not be at all appreciated in the manner it deserved; instead of attributing this illness to the last fancy of the sick person, we can go back definitely twelve days from the first sickening, or fourteen from the first spots of eruption, and trace its source—no idle search, for often, gaining that, further mischief is arrested. The same thing, since the time of Bateman, has been found to obtain in measles, with this difference, that twelve days is more frequently the interval to the full rash than to the first sickness; this sickness, moreover, is traceable for four days before the eruption instead of for only two days, so that the real interval for measles is eight days from exposure to sickening; and this it is the more important to bear in mind, because, as is chiefly established by observations of my own, these four days are not only days of infection, but the very days on which the infection is most frequently spread. It is probable that small-pox is infectious for two days before the eruption.

The duration of infection in these two complaints is certainly not very prolonged: even in small-pox, where it is most intense, the last remnant of personal infection would seem to cease on the separation of the pustular crusts. Infection, it is known, will long persist in these; it will also cling to clothing, and linger in rooms; but with baths, change of clothes, and care as to all other things which have been near the sick, three weeks would appear to be sufficient quarantine for convalescents from this disease. I have seen immunity procured in as short time after measles.

Measles has dangers of its own, which, from the favourable circumstances attending the disease here, we are apt to forget. I suppose a fatality of one per cent. for cases of measles, even in children, would accord with our present general medical experience, and that any excessive mortality would at once attract notice to defects in sanitary conditions, individual, local, or general; yet we have a recent instance, nearer than Fiji, of a fatality from measles of 40 per cent. among young adults. M. Léon Colin, a distinguished member of the Society to which I have the honour of being secretary, informs us in his work 'La Variole,' p. 151, that in Paris, in the month of January of 1871, the mortality of measles in 215 cases among the Garde Mobile was 86, or exactly 40 per cent.; he also shows that in the Special Hospital at Bicêtre, to which he was Physician-in-Chief during the siege, the proportional mortality from measles during the extreme cold of that winter exceeded that from small-pox, though that disease alone in the year of the war caused more than 12,000 deaths in Paris. Beyond the individual privation and fatigue suffered by these victims to measles, the great cause of mortality was cold. The same authority tells us that small-pox was not intensified by the fall in temperature, nor was it appreciably aggravated by a certain unavoidable overcrowding in hospital, while both these causes were highly prejudicial to measles.

The degree of evil from these causes may be better estimated by comparing what we already know of the outbreak of measles in Fiji with the careful record of measles in the United States army during 1863-64, preserved in the sanitary memoirs of the war. In the first year of the war there were 21,676 cases of measles, in the second year 16,345 cases; the deaths were returned as 2,000—a proportion far less than the actual fatality; for Dr. Bartholow (to whom we owe this valuable report) gives, at page 219, the proportion of deaths in two large hospitals as exceeding 20 per cent., and says, 'The medical reports were often vitiated by a false method of expressing results.' Many deaths from pneumonia and bronchial catarrh were due indirectly to measles; hence, the degree of mortality given is short of the truth.

Here we have happening to people of our race exactly what has lately befallen the Fijians; all recondite speculations as to inherited immunity of our own, or constitutional susceptibility of other races, vanish, and we are brought face to face with the innate dangers of the disease when circumstances allow them to appear. From an Australian paper I quote this account by a resident in Fiji:—'The death-rate is not yet made up, but the probability is that 40,000 Fijians died during the four months' plague. The native population of Fiji is now about one-third only of what it was when I landed here twenty-five years ago. Very few died of the measles, the majority dying of subsequent disease in the form of dysentery, congestion of the lungs, &c. Want of nourishment or starvation carried off thousands. Entering a house you would find men, women, and children all lying down indiscriminately, some just attacked, some still in agony, and others dying. Some who were strong enough attempted suicide, and not always unsuccessfully. As the scourge became more permanent four or five were buried together in one grave. In some cases the dead were buried in the earthen floors of the houses, in others just outside the house. The burials were hurried, and it is probable that some were buried alive. In many instances the husband, wife, and children all died. In one village all the women died, and in another all the men. It is said that one tribe buried alive the teacher's wife and children—whose husband and father had died of the plague—to stop infection.'

In Fiji we have no crowding into hospitals, and the salubrious nature of its really warm climate has always been deservedly vaunted, yet 40,000 people, or more than one-half of the inhabitants, are carried off by this epidemic in four months. Thousands were carried off by want of nourishment and care, as well as by dysentery and congestion of the lungs; the worst dangers from crowding were incurred in the small houses; and the worst dangers from cold by the people rushing at once to the water, where they would continue immersed.

Measles in these islands in 20° S. Lat., or within the tropics, corresponds very closely to the facts recorded of measles in the Faroe islands in 70° N. Lat., or near the Polar circle. Intense heat seems also prejudicial to measles, for an epidemic in Australia from which that of Fiji was derived, was most fatal, especially to children, in the hottest part of an unusually hot summer. After the sharp fever of measles has developed the rash, a sudden depression, with marked fall of body temperature, is the peculiar character of this complaint; the depressing effect of intense heat to children is well known, and consequently heat may become at this crisis an exceptional source of danger.

Cold, overcrowding, and want, however depressing at all times to all, are specially so at the time of this disease. Last winter, in the cold week after Christmas, a great increase in the mortality from measles was noted in my part of London, the incidence of which was chiefly on the poor. In the disease itself there was no change of type; the cold was directly injurious in some cases, but in many only indirectly. The high price of fuel aggravated the effects of cold, and instead of good fires and the free ventilation they promote, the crowded rooms, carefully closed for warmth, by affording air loaded with disease particles for respiration, conduced more to lung disease than severe cold can possibly do. It is in the early stage of measles that cold is specifically injurious; however safe and efficacious in scarlet fever is the external application of cold water, in measles it checks the eruption on which safety depends, and abdominal or pulmonary congestions become most fatal complications. A popular appreciation of this fact is shown in the resort to the warm bath for the relief of the severer early symptoms of measles in the young: the use of the cold bath or affusion in relieving the worst onsets of scarlet fever is not so generally known; nor, that early use of the hot bath in bad cases of scarlet fever is injurious.

Scarlet fever affords a strong contrast to measles in all its characters; the interval from exposure to sickening is usually short, and the rash is always an early symptom, so that it ought not to be difficult to separate the sick from the healthy with good prospect of success; and, as a matter of experience, early separation is found generally successful. Moreover, there is this in favour of such a course, that if any of those removed have really received the infection, symptoms of it will appear so soon that no long uncertainty has to be provided against, and a second separation is sure to be timely.

It is well to state more formally this difference between scarlet fever and measles: on separating children from a short, definite exposure to measles, no distinctive illness is to be expected until after more than a week's interval; they are not safe to escape for a fortnight: on separating persons exposed to the infection of scarlet fever a few days, it may be three to five, sometimes a few hours, will suffice for the disease to appear: after a week of immunity we may be satisfied that the disease has been escaped. The utter divergence from, and dissimilarity of, measles to scarlet fever cannot be too forcibly insisted on: these two diseases are representatives of wholly different classes of disease, measles bearing affinities with small-pox, chicken-pox, mumps; scarlet fever with plague, erysipelas, influenza, diarrhœa, perhaps also with cholera. No vestige of place for doubt remains as to the close relation of rötheln, the rash to which much attention has recently been called, to measles, and not to scarlatina; so, the relation of dengue, a rash common in Africa and both the Indies, is clearly and closely to scarlet fever; I doubt if it have more than a superficial resemblance to measles. To speak of any new or anomalous rash as a hybrid between measles and scarlet fever is a confusion of terms and ideas, destructive of what we already know, and obstructive to further knowledge.

A popular recognition of these differences is of the utmost importance to the safe management of the sick, and especially to the safety of others. For instance, is the finely diffused rash of scarlet fever the early symptom? Then separate if possible others of the family: but, supposing the isolated spots or groups of spots of measles appear, doubtless the previous sneezing or coughing will not have been overlooked, and it is too late to separate others, or at least it is wrong to send them among the healthy susceptible. Again, after the rash of measles is fully out, one day suffices for the child to eat and drink and sit up; care against chill and fatigue is wanted, but the illness has suddenly declined with the throwing out of the rash. In scarlet fever the rash is only the commencement of a series of special injuries to which most organs of the body are liable for a period of three weeks, against which rest in bed for all this time is the best prophylactic; after this the special accidents of convalescence are to be feared for another three weeks. Albuminuria and the dropsy which result after scarlet fever are unknown in or after measles. Measles seldom or never recurs; scarlet fever not unfrequently happens more than once.

An important practical deduction from these facts which, if acted upon, would soon reduce the spread of scarlet fever to a minimum, and relieve our healthy seaside towns from one of their greatest risks, is—Do not seek change of air too soon for scarlet fever convalescents: they are better in their rooms for the first three weeks; they are not only safer in their homes for the next three weeks after that, but they gain strength just as fast, often faster, than if they had been sent off for change of air, to the danger of the conveyances used, to the danger of the lodgings they go to, and to the danger of all with whom they come in contact. This is of special importance in the management of schools. Much may be done by domestic management in keeping convalescents not only from school, but from play—theatres, parties, and fêtes—until reasonable fear of infection is over. School managers have a duty to protect their schools; they should have power, so as to be able to exclude from school those known to be likely to bring infection with them. It need not be difficult to obtain a written statement of the illness a child is absent for; then let it be incumbent on the manager not to receive that child for six weeks at least after an attack of scarlet fever.

For the nearer allies of each of the diseases already treated of, some variation is noticed from the typical characters just given. Chicken-pox follows small-pox so far as for the sickening to occur twelve days after exposure to infection; but, instead of the rash beginning two days afterwards, it begins at once, and some isolated spot may always be detected as soon as the first symptom of sickness is felt. There is no more trustworthy guide to so important a matter as the distinguishing off-hand whether it be chicken-pox or small-pox that may have appeared in a family or institution, than to ascertain whether the first spots were preceded by illness or not. I have known chicken-pox to be attended with so much fever, and the spots of so suspicious an aspect, that, but for this circumstance, a fear of small-pox would have remained; also—and this is of greater practical moment—I have known small-pox so masked and modified, that, but for the two days of back-ache and malaise preceding the eruption, some of the necessary precautions against so insidious a danger might have been omitted.

There is the same parallel noticeable in the relation of measles and rubeola (rötheln); in the latter the eruption occurs without precedent illness, or with some faintness or catarrh of only one day's existence, instead of three or four. Perhaps as a consequence of this, certainly as a correllated fact, the period of incubation is always somewhat in excess of what occurs in measles, and may extend to three weeks. This is of importance in receiving among the susceptible any one who has been exposed to this form of infection, in any less interval.

Allied to these diseases is epidemic roseola, marked by a diffused form of rash, as common during the past summer as was rubeola last year. Both are readily distinguished from the rose rashes produced by irritating matters taken into the stomach, as then the illness follows quickly upon the exciting causes, be they food or physic; while rötheln, which most resembles these symptomatic rashes, occurs so long after its exciting cause that the source of infection is frequently overlooked. The *roseola æstiva*, as it has been brought under my notice, resolves itself into one of these two forms of exanthema, roseola and rubeola, which have not hitherto been clearly separated. Roseola differs from rubeola in aspect, for it does not begin in isolated spots, but a finely diffused redness is noticeable, first on the face and neck soon after slight faintness or giddiness has been felt. The small glands or kernels of the neck are palpably enlarged in both ailments, and there is soreness of the throat. This rash may be followed by desquamation, which, rare in measles, is still rarer after rubeola. Roseola agrees with the scarlatina group in having an incubation of near upon a week; another strong affinity is shown to this class of disease by the occasional occurrence of albuminuria, a point contrasting strongly with the measles group in which albuminuria is not known to occur. I have met with one statement that albumen has been found in rötheln or rubeola; I suspect here the rash was of the diffused type I wish to discriminate, for I have examined for myself very many cases of rubeola without ever finding albuminuria, but in a less numerous series of this kind it has sometimes been present. The interest attaching to this consideration is very great, for seeing the close connection of rötheln with measles, roseola, as here defined, might turn out to be some derivative of scarlet fever; the more prevalent is scarlet fever the more does this prevail. Long ago the connection of roseola with summer diarrhœa was noticed by Bateman; the interchange of summer diarrhœa and winter cough is very constant, and has frequently been set forth as closely correspondent. These ailments may seem slight and of no great moment to the strong, but they are serious to the weak, and are the great causes of infantile mortality, especially in great towns. It has been shown how measles has lost much of its fatality with us; could scarlet fever be mitigated and disease particles from it be destroyed, the associated diseases would be lessened immeasurably. Catarrh, when epidemic, is intimately connected with influenza, of which the depressing effects are known to all; on the ingress of this disease in the young, diffused rash over the face, chest, and back is by no means rare; albuminuria also sometimes occurs in this disease as it does in catarrhal croup, both of which are closely associated. Albuminuria has also lately been noted among the prodromata of cholera.

The close relationship between scarlet fever and diphtheria is a matter of common knowledge; the same precautions necessary against the one are required against the other; they agree in the circumstance that either aid their favourable progress, or are hurtful to it. The precaution necessary to prevent the unintentional spread of these diseases by sending among the healthy persons who have been exposed to infection is, that not only should the full week requisite for scarlet fever elapse, but a period somewhat in excess of this; for while as in scarlet fever diphtheria will generally show itself, if it be taken, in three or four days, much clearer instances of it happening after a full week's separation are forthcoming than in the case of scarlet fever. One remark may come in here with reference to these severe pests, which is similar to one made on typhus, that fresh air, good sanitary circumstances, cleanliness, and isolation tend to weaken immeasurably their intensity, and that a mild form of either spreads with less fatality than the severe malignant forms generated by filth and overcrowding.

For all effectual sanitary precautions it is essential for us to set forth as distinctly as possible the fallacy of endeavouring by fixed regulations of a general uniformity to meet the requirements of diseases so diverse as these infectious forms are seen to be. The old quarantaine, or forty days of isolation, would fairly answer the purpose in scarlet fever as it did in plague, but it would be in excess of what is required for many other diseases: three weeks of isolation is very generally adopted now for purification from most infectious diseases; with precautions as to baths, change of clothes, &c., this time has sufficed to keep both measles and small-pox out of our large metropolitan convalescent institutions. To exclude scarlet fever from these institutions the three weeks' interval insisted on before admission is certainly insufficient. Nor, in these days of compulsory education, should children be allowed to return to School Board Schools in so short a time after convalescence: a power of compulsory attendance should be compensated by a power of compulsory absence after infectious illness. In investigating the frequent cases of scarlet fever this season in my own part of London, only one outbreak was distinctly traced to a convalescent institution, one to articles of food and drink, one to sewer-gas, and by far the greater number to schools. The cases from infected food and air did not spread beyond the individuals who originally received the infection, while in the other instances not only the children at the school or institution suffered, but they carried infection to their homes with serious and fatal consequences.

To do away with infection we require, domestic cleanliness and care, and no dishonest attempt at concealment by either doctors or parents. Then no district should be without its special hospital for infectious diseases. 1. These hospitals should be quite distinct from the cottage hospital or general infirmary. 2. They should be quite distinct from convalescent institutions, and should nurse their own convalescents until all fear of infection is over. 3. They should be supported by the public rates, for all should contribute to what is for the benefit of all. 4. They should be under stricter and more centralised supervision than is required in our voluntary establishments. 5. They should be constructed on well-considered plans, providing separate rooms for different diseases, and a probationary ward for doubtful cases.

A fair share of public attention has been shown to these requirements in London under the direction of the Asylums Board. The Hampstead agitation indicates with what dull weight prejudice may clog progress. Not only at Hampstead, but in every district, a hospital for infectious diseases is wanted. Such hospital should be known as a source of security, and not of danger, to the neighbourhood where it is situate. The London Fever Hospital has its scarlet fever ward within less than eight yards (23¾ feet) of Theberton Street, but this proximity has occasioned no case of scarlet fever in that street during all the twenty-five years the hospital has been there. When the Small-pox Hospital and Fever Hospital were close together at King's Cross, no case of small-pox ever broke out in the Fever Hospital, and only once did fever occur in the Small-pox Hospital; this was to a nurse who had steps placed to the dividing wall to visit her daughter, who had fever.

Infectious disease is not the inscrutable visitation many suppose. Pestilence no longer walks in the darkness in which it was so long enshrouded. Infection is no longer a vague and pervading influence, either telluric or atmospheric; it is known to depend on particles, not floating about indefinitely, but clinging to near surfaces. Without care and cleanliness, it may easily be carried by those who are near the sick; it cannot be carried far in the air, for fresh air oxidates and destroys it, so that for the most subtle diseases the infecting distance is small. The sources of infection should in all cases be sought out; it is important to find them, and I for one am never satisfied till such a quest has been tenaciously pursued: it is the only way effectively to reduce the prevalence of infectious diseases.

A leader in the *Times* of this week, on the opening of the London Medical Schools, appropriately expresses the conclusions arrived at:—‘The interests of all professions are identical with those of the communities within which they move and by which they live, and hence every class should seek to unite itself to others by the bonds of comprehension and sympathy, rather than to conceal its actions behind mystery and verbiage. Everything which assists the public to understand the work of medical practitioners and the difficulties by which that work is beset, and everything which diffuses a knowledge of the points in medicine about which certainty is attainable, as well as of those to which experience must feel its way through doubts, will contribute towards setting difficulties and doubts aside. If we were to select a subject which more than any other appears likely to throw new responsibilities upon the profession, and on which an opposition begotten of prejudice has to be overcome among the public, it would be the propriety, comparatively lately made known, of isolating the victims of contagious disease from the persons around them. Sickness in a household has been hitherto regarded as a matter of private rather than of public concern, and the only medical duty hitherto recognised in relation to it has been that of placing the sufferers under conditions conducive to their recovery. We are beginning to take a wider view, to recognise that when the sickness is contagious it may easily from a private calamity become a public one, and that it should fall under the notice of the public authorities just as if it were a fire or an inundation. Such an aspect of the matter entails new responsibilities upon the doctor, and renders him not only the attendant upon the sick, but also the protector of the healthy. He is charged with the duty of discovering and of announcing the danger, and with the duty of stating and explaining the means by which it may be averted. A small advance of opinion would enforce the performance of these duties by legal enactment, and would invest the necessary recommendations with legal authority. Among them the isolation of the sick must in many cases take precedence of all others, and the one fact which the public ought to know is that such isolation promotes the recovery of patients as much as it secures the safety of those who are still sound.’

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ON THE PREVENTIVE INFLUENCE OF OUR

INCREASED MEANS OF

Isolation in Infective Fevers.

The following abstract of a contribution to the Section of Public Medicine at the Annual Meeting of the British Medical Association at Brighton, read there more than ten years after the preceding paper, reaffirms the utility both of small-pox and fever hospitals in checking the prevalence of these diseases in London. That means for isolating the sick should be provided in any large community as a first step towards checking the spread of infectious epidemics has long since been admitted, and is at length, after considerable effort, fairly carried out in London. The success that has followed, not unexpected, is great in a remarkable and unexampled degree. The clamour against the special hospitals requisite to this end is now restricted to those for small-pox; it is conceded that scarlet fever hospitals produce no injurious influences around them, and the control of scarlet fever consequent upon improved means of isolation is most marked. Yet the *Times* newspaper now decries what, in the extract above given, it once so ably advocated. In a leader of January 21st, 1887, on the Decrease of Scarlet Fever in London, it says, "there is not the smallest reason to suppose that treatment in hospital has anything whatever to do with it." This reflects some arguments in the medical press now to be considered. As to small-pox, it is contended that though the increased hospital accommodation in London had three times in eleven years reduced the small-pox mortality from epidemic proportions to amounts exceptionally low, yet that these hospitals tended to keep up epidemics, and that cases of small-pox were found in parts of London near special hospitals more than in other parts. The disastrous ability of these hospitals to spread small-pox is supposed to extend to the distance of at least a mile, and to be independent of lines of human communication. It is said to be excited when the number of acute cases in a hospital has been restricted to 20 or 30, and that "it was on one occasion exerted when only five acute cases were in the hospital together." How this last point was established is not clear. If true, it proves too much, for if infection spreads from 30 patients in hospital as well as from 300, and five patients give rise to the same danger, we should return to the use of a large hospital, as one centre of infection is better than many. In some districts small-pox had reappeared before the special hospitals were re-opened, and the relief given to the neighbourhood by these establishments may be fairly considered to counterbalance the possible injury attributed to them. The main result is that we have a more complete immunity from small-pox in the metropolis than was ever before known.

The abstract of the paper read, August, 1886, is this:—Diseases propagated by personal infection have, under an improved sanitary engineering, showed no diminution until efficient measures of isolation were established. The scarlet fever mortality for England and Wales stood at 12,000, with epidemic leaps, as in 1864 and 1874, to 20,000 and 30,000. In London alone the mortality from this cause in 1870, the first year of compulsory school-attendance under the School Board Act, exceeded 6,000; the deaths from scarlet fever in London have averaged in the last twenty-five years, more than 2,000 annually. Last year the scarlet fever mortality in London was 700; for the first quarter of the present year it was only 102—not much over half of any quarter of the previous year, less than one-third of what is recorded for 1884, and the lowest number registered in London from scarlet fever for the fifty years that registration has been established; the result, as I shall show, of recently improved and extended means of isolation.

Small-pox and scarlet fever may here be considered together; they, with typhus, are the only truly infectious diseases that have been dealt with on a large scale by isolation. The efforts of the Metropolitan Asylums Board to meet the requirements of the great outbreak of small-pox, 1870-71, first increased the necessary hospital accommodation. The various impediments encountered led to a further increase in this direction, and then to a greatly extended and improved ambulance system. Obstructions that interfered with the control of small-pox had the effect of diverting much of the increased hospital space to fever patients. The spread of typhus, that had again threatened some parts of London, was arrested. Special wards for this and for enteric fever were found sufficient, but the need for convalescent quarters for scarlet fever and small-pox was soon apparent. The rapid and permanent collapse of the small-pox epidemic when the Darenth establishment was complete, leads to high expectations from the institution now near completion for scarlet fever convalescents at Winchmore Hill.

The first action of the London Asylum Board Hospitals was to reduce the small-pox mortality in London from 9,698 in the two years 1871-72, to 113 for the year 1873, and to 103 only for the two years 1874-75—lower figures than had ever been known for small-pox in London. Litigation and ill-advised restrictions had so far interfered with the means of dealing with the 1876 outbreak of small-pox that the epidemic increased the following year, was barely held in check till it rose to an epidemic again in 1881 and 1884, and was not finally repressed until last year. Then the camp for 1,000 convalescents at Darenth had so aided the hospitals that in the latter half of 1885 the deaths in London from small-pox were 97, 13 of them in the last quarter of the year; and for the first quarter of the present year one only. All the other fatal cases, amounting to 13, had been removed from London, and were treated at the hospital-ships in Long Reach.

In 1884 and 1885 the hospital ships were reinforced by the newly fitted *Castalia*, and removed to Long Reach below Dartford. In these two years 10,718 cases were treated on board. Last year there were 5,644 admissions of small-pox patients, 4,069 from their homes and 1,575 from other hospitals. The deaths were 444, being a mortality of 7.6 per cent. Dr. Birdwood, in his report for last year, says, page 7: "The severe cases are treated together; on the *Atlas*, 30 acute cases have been in bed at the same time on one side of the decks; on the *Castalia*, in No. 3 Ward 20, and in No. 8, 14 beds have been occupied by confluent cases for several weeks. Neither patients nor staff were injuriously affected." He further remarks, page 14: "The first use of the ships at Long Reach was to promote the recovery of convalescents. Mild cases were next received, then moderately severe, and now all cases, except those in too extreme a condition of illness to be conveyed safely by the admirable steam river ambulances, are sent direct to the hospital-ships as soon as the first symptoms appear. This early removal is of the greatest benefit to the patient, and one of the essentials towards the arrest of epidemics." The report of Dr. Phillip on the River Ambulance Service shows that, from February 9th, 1884, to the end of 1885, the number of patients removed to Long Reach was 11,060; and of these 10,076 were brought back well. Instead of less than half the fatal cases occurring in hospital, as in 1877, more than three-fourths of all the deaths from small-pox are thus accounted for, and the control of the epidemic is assured. In the same way, the proportion of fatal cases of typhus treated in the board-hospitals increased from 10 per cent. in 1876 to 40 or 50 per cent. in 1881; and the whole number of deaths has fallen from 163 in the former year to about 30 annually.

This evidence of control over scarlet fever is, happily, increasing year by year. From 1875 to 1877, the proportion of scarlet fever deaths in the board-hospitals was only four per cent. of the whole number of deaths in London; this has risen to 16.4 and 19 per cent., showing that the means of isolation have increased four-fold. However groundless the fears entertained by the Royal Commission as to the possible ill-effects to small-pox patients from being treated in any numbers together, the limitation imposed by that Commission in the London hospitals set free many wards for the treatment of scarlet fever. An injunction in Chancery, practically closing the Fulham Hospital against small-pox, enabled a number of scarlet fever patients to be received from the neighbourhood, with marked good effect in the epidemic prevailing around. Again, these legislative hindrances, if they tended to an increase of small-pox by indirectly enforcing a sort of traffic with this disease through various parts of London, were productive of improved organisation of the methods and means of moving the sick.

Considering the rapidity of ingress in scarlet fever, the hospital for the reception of acute cases should not be at any great distance from the district to be benefited; a convalescent institution at some greater distance, accessible from the fever hospitals, is desirable. To carry out this necessary adjunct, the Metropolitan Asylums Board have nearly completed, at Winchmore Hill, a sanatorium for 416 scarlet fever convalescents. The number of hospital beds provided for scarlet fever cases is about 500; this number could be increased on occasion, as the number of beds provided for fever cases by the Asylums Board is 936; for small-pox cases, 600 beds are available. The ambulance system, with its centre at Norfolk House, Norfolk Street, Strand, close to the Thames Embankment, in telephonic communication with the different hospitals and ambulance-stations of the Board, ensures the prompt removal of either of these infectious illnesses which cannot be well attended to or isolated at home.

It may be premature to attribute the recent remarkable reduction in our small-pox and scarlet fever epidemics exclusively to our efforts towards isolation, but it is well to call attention to the coincidence. The periods for epidemic increase of both these diseases is again close upon us, and it is to be feared that a pause in these efforts may allow them to advance. There has been delay in sanctioning the necessary outlay at Darenth for a permanent establishment. Our authorities seem to accept the principle of isolation, and then to yield to popular prejudices by postponing the execution of the necessary works. Even Winchmore Hill is not completed; and, instead of being ready beforehand to meet the increase of scarlet fever, always present in the autumn and already noticeable, the Asylums Board wait till there is a more obvious public necessity for its installation. Are we always to be behind the changing requirements of the times?

The better classes can mostly be very efficiently isolated at their homes. The London Fever Hospital attends to all claims in emergency, and is of great assistance both to the upper and middle classes. In the lower middle classes and the poor, the Asylums Board hospitals are now readily available, and are constantly extending their influence. We also gladly acknowledge the good work done by the careful and intelligent management of the sick at their homes, through the intervention of skilled nursing, and care as to isolation of the affected through kindly supervision and advice in illness. The efforts in this way to check the spread of scarlet fever in Hastings, by Mrs. Johnstone, have been found not ineffective in the more crowded parts of London and Westminster. Foremost in the attempt to prevent the spread of scarlet fever, of so frequent occurrence during convalescence, must be placed the splendid effort of Miss Mary Wardell, in opening a convalescent establishment at Brockley Hill, where forty or more inmates may have the benefit of fresh air and every necessary comfort until health is re-established, and all fear of communicating the disease to others is passed. Up to the opening of this institution, the London Fever Hospital always kept its convalescents until the period of infection was over; as this mostly exceeds six weeks, it is obvious what aid may be afforded by a convalescent home. In the first report of the home at Brockley Hill, it is satisfactory to see that thirty-four cases had been received direct from the London Fever Hospital, and twenty-two from other hospitals. Some relief has been afforded in this way also to the Asylums Board hospitals, as well as to numerous families.

THE recent epidemic, 1887, of scarlet fever in London has tested to the utmost the means of isolation provided. A subsidence of enteric fever during the present summer, and the absence of small-pox from London, enabled the Metropolitan Asylums Board by using a large proportion of the beds reserved for these diseases, and, by other efforts, to treble the number of beds set apart for the reception of scarlet fever patients, and to double at Winchmore Hill, within a month of its occupation, the accommodation intended for convalescents. By the end of October the Board Hospitals contained 2,100 scarlet fever cases and 400 convalescent, with less than 150 of enteric and other fevers. The number of beds held in reserve being 95 for scarlet fever, 18 for enteric fever, and 30 for other cases, or for isolation purposes.

The perfected ambulance system organised by the Asylums Board and the ready way in which the help thus afforded to the sick poor was obtainable, had become well-known in London, and such aid was habitually sought in the early part of the year before the advent of this scarlet fever epidemic was realised. The deaths from scarlet fever had risen in the second quarter of the year to 192, of which the large number of 63 occurring in three of the Asylums Board Hospitals, showed how largely the aid of these hospitals had been sought. Still the deaths only averaged 16 a week, or a yearly rate of 0·18 per 1,000 inhabitants. During the first half of the next quarter the weekly average always exceeded 20 ; in the second half this was over 42, the whole number was over 480, and the rate for the whole quarter 0·4 per 1,000.

This increase was soon obvious to the health officers of London, it had been earliest known to the Metropolitan Asylums Board. Attention was called as publicly as possible to the demand already made upon the resources at hand, and to the necessity for extending them. The *Times* of August 29th, 1887, in referring anew to the subject, at length stated in a leader that "there is reason to believe that the explanation of the comparatively low London rate (of deaths from scarlet fever) may be found in the beneficial provision made by the Metropolitan Asylum Hospitals for the reception and isolation of patients."

At this time the Chairman of the Metropolitan Asylums Board urged the opening of Winchmore Hill for convalescents; even on September 10th with more than 1,000 cases under treatment, and patients coming in at the rate of 20 a day, this necessary step was further delayed. At the end of the month when the removal of convalescents gave more space for acute cases as many as 72 fever patients were admitted in one day, 3 of them enteric and 69 scarlet fever. At this very time the mortality for all London fell from 53 and 57 a week (September 17th) to an average of below 40 for the next three weeks. After the first week of October convalescents were being discharged from all the Board Hospitals, yet 1,291 new cases were admitted in the month, and always more than 2,000 were under treatment; at the same time 122 new cases were received in the London Fever Hospital, and those of a worse type as is very generally the case in October. The whole scarlet fever mortality of the Metropolitan Asylums during this epidemic has been, that of last month excepted, always less than one third of that for all London.

In the absence of any system of notification of infectious diseases for London, the returns of the Metropolitan Board supply the only means of noting how far the returns of mortality can guide to the prevalence of any epidemic amongst us. It would appear that not only does this kind of return come too late to be made available for the control of an epidemic, but that it is misleading. The Asylums Board have no compulsory powers for enforcing notification, but by affording the refuge so much needed in these illnesses the sufferers come and in such numbers as to proclaim where infection is most rife. Without the system that has so recently been perfected, we should have been in ignorance of this amount of scarlet fever surrounding us. The actual deaths this year from scarlet fever are less than in most epidemic years and do not exceed the decennial average. The means for arresting the spread of the epidemic may also have contributed towards lessening its fatality. Moreover the Board statistics gave warning when the numbers of scarlet fever cases last year were low that their increasing severity threatened a further outbreak this year. In two of the hospitals open only in the first half of the year, 1866, the mortality was 5½ per cent., while in two open during the whole year this was 8·9 and 11·8. In these latter three-fourths of the patients were young children.

A valuable store house of facts bearing on the history of our London epidemics, is found in the annual reports published by the Metropolitan Asylums Board, with the tables prepared by the medical superintendents of each hospital under the supervision of a statistical committee. From the report for 1886 the rise of the epidemic of scarlet fever may be traced. The full account can only appear in this year's report, but some of the results already in the hands of the committee have been kindly forwarded by the Clerk of the Board on request, and deserve a cordial acknowledgment.

RETURN OF ADMISSIONS and MORTALITY OF SCARLET FEVER CASES at BOARD'S HOSPITALS, during the under-mentioned periods:—

	No. of Patients Admitted.	Number of Deaths.	Per-centage of Mortality.
Quarter ended 31st March, 1887 ...	463	41	8 · 8
Quarter ended 30th June, 1887 ...	606	53	8 · 7
Quarter ended 30th September, 1887 ...	1922	128	6 · 6
Month of October, 1887	1291	93	7 · 2
TOTALS	4282	315	7 · 3

4th November, 1887.

ON

GLYCOSURIA

AND THE RENAL SIGNS OF

PERVERTED NUTRITION

WITH THE

TREATMENT OF DIABETES

AND OF SOME CONDITIONS ALLIED TO GLYCOSURIA.

BY

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ON THE RENAL SIGNS OF DISORDERED NUTRITION.

> "A Mans owne Observation, what he findes Good of, and what he findes Hurt of, is the best *Physicke* to preserve Health. But it is a safer Conclusion to say: *This agreeth not well with me, therefore I will not continue it;* Than this; *I finde no offence of this, therefore I may use it.* For Strength of Nature in youth, passeth over many Excesses, which are owing a Man till his Age. Discerne of the comming on of Yeares, and thinke not, to doe the same Things still; For Age will not be Defied."
>
> *Bacon.*

In my essays on the health of children, many facts are set forth to further the progress of definite ideas in matters medical, and to lessen the uncertainties of medicine; it is hoped that some of the following conclusions, though drawn from a smaller number, but not an inconsiderable series of observations of another kind, may be acceptable, if not serviceable, to all who are concerned in the advance of medicine as a science. Two things appear from the comparative study of such cases as follow: one is that Glycosuria, and in all probability Diabetes, come under the denomination of preventable disease; the other that though this form of disturbed nutrition may occur at any age to either sex, the liability to it, greatest after middle age, is nearly equal for the two sexes. A word more on both these points; the formula "once glycosuric always glycosuric" fades to the faint image of a truth, existent in the background, before the numerous instances of complete recovery from attacks transient but persistent enough to have caused anxiety for months. Of the thirty cases mentioned at p. 15; the more alarming and serious ones show no recurrence of glycosuria under the various trials of health brought by further advance of years. On the other point; statistics published by our best authority on Diabetes, Dr. Pavey, make it much more frequent among men than women; perhaps it need not be a matter of surprise that those who see most of women's ailments should make the proportion the other way; it seemed strange, however, to me that among a series of men undergoing the same careful examination for another object by my old friend, Sir Henry Thompson, that Glycosuria should, as he informs me, be very rarely found. The concurrence of uric acid with glycosuria has ever since the time of Prout been regarded as of good omen for the latter; it may be that we here have the converse of Prout's law, and that glycosuric subjects escape the worst consequences of lithiasis. In the above instances, a previous medical examination has increased their value for the purposes in hand. Were patients to separate themselves into groups before going here and there for advice, the cases coming under the notice of the specialist would be more mixed; my experience of a large number of those said to have rheumatism, shews that home-made diagnosis is more often wrong than right.

The uncertainties of medicine recede with any forward step made on sound deductions from facts slowly accumulated and carefully compared; they re-appear with the easy repetition of old or new theories, or the lightly adopted guess, the latter sometimes recommended on the false ground that it may be supported by subsequent experiments. These should precede and not follow assertion. Our knowledge of Diabetes has been of late thus obscured; the risk from surgical operations in this state is not increased since the use of Chloroform and Ether, as some suppose; others discover a special *pruritus* long ago mentioned by standard authors. As to a hypothetical acetonæmia; lately large quantities of acetone have been given (Baginski, Berlin Phys. Soc., 1887), for a considerable time without the effects on the nervous system that have been attributed to it; acetone is found in most febrile attacks, in some stages of growth, and in disturbances of digestion derived from the breaking up of albuminoids; it is not found in rickets nor during lactation.

The Uric acid diathesis should also come under the control of an advancing preventive medicine; a restricted diet alone does not suffice for this. A general failure of health may be traceable to over stress or impediment in one organ or function, and health returns as this is relieved. Even in age, local failure comes before general decay; a disturbed equilibrium in the work and waste of the body may often be observed in time to ward off an attack of illness, either by rest or diet; it is only permanent organic injury that necessitates habitual restrictions in food and work. The first failure in health may be of such kind as to lessen comfort rather than activity. The dyspeptic with contracted stomach has to do with less food than others, and may have to economize exertion. Still more care as to ingesta is required with weakened liver or kidney, sufferers from renal defect stand chill or exposure as badly as those who suffer from pulmonary complaints. An unjust discrimination is mostly made as to the relative share of gastric, hepatic, and renal disorder in defective health; stomach disturbance is put down to biliousness, when the diminished size of the liver, easily determined by percussion, shews that this organ is not receiving material enough for active function; the opposite to this occurs in glycosuria, and in this and some other disorders the kidneys are blamed when the liver is at fault. Sometimes renal excretion is below the normal from impaired hepatic action. Not only are the products of disassimilation transformed in the liver and prepared for excretion, together with some normal toxic principles from intestinal change, but poisons from without, including the medicinal alkaloids, are destroyed in the liver, and this the more quickly when its glycogenic function is most active; thus aiding greatly the active elimination of drugs by the kidneys. When the powers of either organ are weakened certain drugs must be given in smaller doses at longer intervals or they acquire a cumulative action. Some drugs modify the activity of both organs. Lead and Opium check their secreting power; Colchicum directly, Digitalis indirectly, with opposed cardiac influence, increase their activity. Where opium is relied on in the treatment of Diabetes the diet is also altered to a great extent, though no dietary restrictions are said to be enforced. The new coal-tar derivative, Saccharin, is not so available a substitute for sugar as is Glycerine.

ON GLYCOSURIA AND OTHER SIGNS OF PERVERTED NUTRITION AFFORDED BY THE KIDNEYS.

POPULAR comments on the uncertainties of medicine, sometimes supported by the sayings and doings of the medical profession, are often too readily admitted by most of us. We, as members of that profession, should, more frequently than we do, rather point out the certainties already acquired, and the common facts known to everyone on which rest much of our knowledge of disease and its treatment, as affording a solid foundation for the forecasts we are able to make, and the advice which we give to our patients. There are physical, chemical, and even vital facts, from which we form our conclusions, that can be appreciated by most people, and which should be more widely known. The dulness of the percussion-note over the disabled lung or the enlarged liver can be heard by others than ourselves, and the stridor of croup by those near; even the wheeze of asthma gives to all an idea of what may be revealed by auscultation. The distortion of a broken or dislocated limb is to be seen, and the crepitus of fracture felt by anyone, so are certain contractions and distensions of other parts, though skilled interpretation of the significance of these signs may be wanting. The evidence afforded by the thermometer is of more general comprehension, while the loss or gain of body-weight, one of the most important differentiations on which we can rely, is as simple a certainty to the patient and friends as to the doctor. Besides the physical means of research supplied by the measure and the balance, we sometimes place in our patient's hand test-paper as a chemical reagent or show him the effects of heat and acid on albumen; the vital phenomena of paralysis are mostly too obvious, and in obscurer cases the use of galvanic currents is intelligible.

What auscultation is as our guide to diseases of the chest, palpation to those of the abdomen, nerve-signs to the various affections of the brain and cord, such the examination of the urine is to diseases of the kidney—a means of knowing exactly the part that is out of order or diseased, the exact mode of alteration, and the stage to which it has advanced. This is so well understood, and has been so thoroughly worked out, that little need now be said on this head. But the secretion distilled unceasingly from the kidneys is more than a witness to the state of the kidneys, and to the perfect order of all the parts of the apparatus concerned in the elimination of urine; it is evidence of the way in which the functions of the whole body are being performed, of the general rate and activity of change throughout, and of the particular excess or defect in special organs and functions. The greater part of the nitrogenous waste of the body has to be eliminated by the kidneys: they have thus a constant duty; the integrity of these organs is therefore of the greatest importance, as they have to carry off the results of increased tissue change from febrile or other disturbance, as well as any excess of nitrogenous matters taken in the food, many products of imperfect digestion, most of the deleterious matters accidentally or designedly imbibed, and some of the special products of diseased action. Thus attention to the characters of the urine is not only the guide to kidney disease, but gives valuable information of tissue change in the body, and of disease that would otherwise go on undetected.

These variations are for the most part easily noticed by the patient, such as the high colour and deposit in febrile states, and the increased quantity in diabetes, so that we may expect to have our attention directed to them. Those changes, on the other hand, which betoken disease of the kidneys themselves, are not so much under the patient's observation; and, generally, it is not from any complaint made to the doctor, but from his examination of the urine, that the first indication of the different forms of Bright's disease are ascertained. Here, again, a little more attention on the part of the patient would have led to an earlier recognition of renal disease; the appearance of blood in the urine or its coffee-like deposit in the acute congestion of the kidney, and the much diminished secretion of repeated attacks ought not to have been unnoticed. Any marked increase in the quantity of urine secreted, or in frequency of micturition, should also attract attention. Nor are these changes altogether unnoticed, but the illness that attends them passes; it is put down to cold or indigestion and not till the first examination, perhaps months after, reveals the true nature of the illness are the first symptoms remembered.

The early recognition of kidney congestion enables us to be confident of its cure. We have seldom to look upon some degree of albuminuria in the course of an ailment with the anxiety which its presence once used to agitate our minds. We know that in most cases it will clear off; the more general and routine testing for albumin has shown how frequently it appears, and how completely it will disappear if rest and care be duly observed. Bright's disease is being continually prevented by our more systematic examination of the urine. Not only is this true for organic disease of the kidney, but it is largely so for the arrest of that most serious constitutional disturbance, diabetes, or for averting its worst consequences. In the particular series of cases now to be brought under review, the instances where albuminuria has been a mere passing occurrence are less numerous than those of temporary glycosuria. Those of chronic renal disease exceed the number of cases of persistent glycosuria, while those of acute kidney affection with recovery, and of threatened diabetes arrested, are about equal.

The object at present in view is neither the discovery of kidney disease, nor the exclusion of diabetes—a single examination mostly suffices to determine these points—but to insist on the value of frequent periodic recourse to the state of the kidney excretion as a guide to abnormal action in other organs, and to the nutritional changes of the whole body. For evidence against the much-abused liver, an organ more sinned against than sinning, it is safer to trust to the signs of biliary colouring matter in the urine than to any supposed bilious look in the face or a yellowness of the complexion; the latter may result from a temporary congestion, perhaps from the relaxed vessels of exhaustion, or the bloodshot eye of watching or grief, with anæmia rather than lithæmia, and not from impeded action of the liver or from bile in the blood. The true icteric tinge is readily distinguishable from the above conditions, but not always from the tinge given to the skin by other cachexiæ; when discolouration is owing to bile in the blood, its presence in the urine can easily be verified by the green change produced by a drop of iodine solution, and, this evidence is required to show that bile is still present in the blood, as the staining of the skin may remain after its cause has ceased to exist. Frequent examination of the urine might afford a clue to the early diagnosis of obstructed gall-duct, from those more profound causes of jaundice which come under the head of arrested metamorphosis or perverted nutrition.

The presence of biliary acids in the urine is not so conclusive of anything wrong with the liver as is often assumed; without a concurrence of tenderness and fulness of the hepatic region, or of undue resistance and altered outline, it is rash and often injurious to infer an hepatic origin for our patient's ailments; even with these local signs, debility, anæmia, heart disease, or malaria may concur in their causation. The furred tongue and loaded urine of dyspepsia and gastric or duodenal catarrh are beginning to be rightly appreciated ; in these cases there is nothing wrong with the liver. A little hot water added to the turbid urine clears off at once the fear of this being due to anything wrong with the kidneys, and shows that they are merely sharing the extra work brought about by temporary disturbance of equilibrium. The more numerous so-called class of "bilious attacks" accompanied with headache or megrim, where the tongue is clean and the urine clear and abundant, are entirely neurotic.

Several of the more common variations of the urine require mention : under normal conditions, if the quantity is increased the specific gravity falls, but a persistently low specific gravity points to impaired kidney function, and may be associated also with such signs of faulty assimilation as the presence of uric acid, oxalates, and even sugar ; on the other hand, a specific gravity of 1025-30 is no proof that a sufficient elimination of urea is going on, for the quantity of the fluid may be reduced to fifteen or twenty ounces in the twenty-four hours, and the total elimination of urea to one half of what it should be. In all cases it is important to know what is the daily quantity, and whether under present conditions that quantity is increased or diminished. In most cases the exact measurement of quantity for one twenty-four hours should be obtained. Where one is consulted only at intervals, it may suffice to direct that the water brought for examination should have been passed at certain specified times. In other cases it may be directed that the whole quantity for the day or night should be reserved for inspection. No case that requires repeated medical attention should be without at least one record of the state of the urine ; when there is nothing wrong, such a record is often most valuable evidence in subsequent illness ; it is a ground of confidence at the time, and afterwards may be a guide to treatment, or aid in securing a favourable life assurance that might otherwise be refused.

Besides having in all cases always made the usual notes as to the urine, the routine of the last forty years in our hospitals, for the last few years it has been my rule to use Fehling's cupric test as regularly as nitric acid. The solutions of copper and of the alkali should be kept separate and mixed at the time of using, otherwise discoloration is apt to occur with reducing agents of less activity than grape sugar. A remarkable red or orange opalescence is produced with this test in a certain number of cases where no oxide of copper is actually reduced and deposited. In some of them, as in those where glycosuria has existed, a little fine oxide will in time subside, but in others nothing of this kind occurs, and the causation still remains doubtful; it has been found with excess of either uric acid or of oxalate of lime, though it is not always thus associated, and some peptones in the urine act in the same way; the general condition accompanying it is mostly one of impaired health, with either dyspepsia, fatigue, and low spirits, or with more serious disturbance. and perhaps chronic organic disease. It may be found for a short time only, or persist for years. Supposing the turbid orange deposit indicative of the presence of sugar to occur, for determining its quantity we bear in mind that each drachm of Fehling's solution is equal to a quarter of a grain of sugar or glucose, so that beginning with two drachms of urine in the test-tube, and heating it successively with one drachm and then with a second drachm of the test, we readily see if the quantity of sugar present equals or exceeds one or two grains to the ounce; when in greater excess, first dilute the urine with three times its bulk of water and proceed as before; then, if necessary, deal with one fourth of this in the same way; it is obvious that each drachm of test used in the first dilution is the equivalent of one grain of glucose instead of a quarter of a grain, and in the second dilution it is equal to four grains to the drachm of the fluid under examination. The result thus obtained has been checked by the volumetric and fermentation processes, and found to be accurate.

Among the last two hundred cases in my note-book, I find that glycosuria has existed in no less than thirty-one. Of these, five had been under observation previously, two being cases of diabetes, two of persistent glycosuria, and one, a young man still under forty, who has long been free from all signs of diabetes that once threatened.

To the two cases of persistent glycosuria, both over fifty, a man and a woman, I have to add three others, a man of about fifty and two older women; in those, diet and care control the amount of sugar, and sometimes remove all traces of it; they know for themselves when and to what degree dietary restrictions are needed.

There are six cases of persistent or recurrent glycosuria, the amount mostly small, and rarely requiring special dietary precautions; four of these are in persons over seventy years of age, one is a spare active man with failing memory, and three are rather stout women, one arthritic, one active but at times depressed, the other with slight albuminuria and other signs of degenerative changes; two of these cases are women of middle age, one active but neurotic, the other intemperate and with chronic changes in liver and kidneys.

Twenty cases remain where glycosuria has completely disappeared; five of them suffered to a serious extent while under observation; in these five, two years have elapsed in two cases, and more than a year in two without recurrence, so that the tendency to diabetes in those cases is for this length of time at least escaped. Two of the cases were men and two women, all a little over forty years of age; in each case there was a considerable amount of uric acid either with or after the glycosuria; in one case, where the amount of glucose averaged ten grains per ounce for nearly six weeks, and the quantity of urine varied from five to eight pints in the twenty-four hours, there were arthritic and thoracic complications. One of the men first came under my notice for serious hæmoptysis soon after his return from India, and was considerably emaciated; both the women were stout, and unable to take much exercise. The remaining case, a man æt. fifty, belongs to the larger category where no question of diabetes had before arisen, though subsequent experience in this and in some cases of both classes may not be entirely without danger of that contingency.

There remain then fifteen cases of transient glycosuria—six men and nine women; four of the men were over fifty years of age, and two were under forty years; five of the women were over fifty, and three under forty years, one, a girl of twelve years old, after scarlet fever. This girl, who was generally healthy and well-grown, had in January 1884 a trace of glycosuria; in ten days this had completely disappeared, after a little rest from Christmas festivities, with slight modification in diet, and was absent at the end of April. She had had scarlet fever in the previous summer, with glycosuria from the fifth to the tenth day of illness; the highest temperature was 104° on the fourth day; on the fifth day the tongue was moist and the skin very red; urine 1020, clear, high colour, no deposit, no albumen, but a trace of sugar; on the sixth and seventh days the temperature fell to 101° and 100°, the tongue was red and tender, there were some doubtful articular aches and pains, the urine was freer, with both phosphates and uric acid in excess, the sugar equalled one grain to the ounce; during the next two days the sugar increased somewhat, but did not exceed two grains to the ounce; it had disappeared altogether by the twelfth day, and was not found at the end of three weeks; desquamation began on the eleventh day and was not over till the thirty-fourth, when convalescence, which had been uninterrupted, was complete. Glycosuria has been noted as occurring late after severe scarlet fever; I have not met with it before in the early course of the disease, nor have I found it yet in whooping-cough.

Two other of the above cases in women are remarkable as following severe attacks of summer diarrhœa; the first, a nurse, aged twenty-seven, suffered extremely from contaminated drinking water, in July, 1883, severe diarrhœa and vomiting lasting five days; she had some secondary fever, with pain and thirst another five days. A month after this she continued weak and thirsty, the urine in excess, pale, sp. gr. 1016, with two grains of sugar to the ounce. A month later, with special care as to diet, recovery was complete. The second case met with after diarrhœa in the summer of 1884, had no glycosuria after a similar attack in the last hot season. Two exceptional cases were found associated with delirium-tremens; in one, a man under forty years of age, glycosuria was not discovered till the attack was passing off; in the other, whose attack was not the first nor the worst that had been experienced, this occurred on the second and third days after being without alcohol; there were tremors and want of sleep, the bowels had acted, and the tongue was clean; soup and eggs were taken freely, urine 1022, high in colour and darker with nitric acid, no albumen, but well-marked trace of sugar; next day, after sleep from bromide and Indian hemp and no restriction in diet, milk being allowed, the urine was paler, free, giving only a red opalescence with the cupric test, and depositing numerous oxalates. During convalescence, Fehling's test was no longer discoloured though oxalates continued to be abundant; there was no microscopic evidence in the urine of renal mischief, and with a daily secretion of fifty ounces, sp. gr. 1016-17, a prospect of longevity is open to this elderly paroxysmal tippler which is closed to the younger victim. I have one case where slight glycosuria and a little albumen appeared during the treatment of some tertiary nerve symptoms; both entirely disappeared.

The more ordinary cases, then, in which transient glycosuria has to be accounted for or its associations stated, are nine only—four men and five women. All are over forty years of age, one of the men and two women are a little over sixty years; one of each sex is stout; all have been active and, excepting the youngest woman who is neurotic, are energetic, temperate, and accustomed to live regularly and well. Two of the ladies are liable to excess of uric acid. The two others, both over sixty years of age, have been rather tried with family cares; one was affected in the manner under consideration for a short time after a domestic trouble; the other after the fatigue of a continental tour; in this case the glycosuria was soon overcome, but there is recurrent albuminuria and marked general debility. Of the four men, the oldest, who is stout, had noticed uric acid at times, and once the urine had afforded a red opalescence with the cupric test before it gave decided evidence of sugar; this was soon removed and no special diet required; he had some pulmonary congestion last winter, the heart is weak, he is of sedentary habits, and has been too dependent upon blue pill. The next man, at fifty-eight, much occupied, caught cold on a business journey last winter; it left him weak and restless with cough, but no pulmonary râles, he had lax throat, clean tongue, increased extent of hepatic dulness, bowels kept free by frequent pills or seidlitz powders, urine 1030, lithates, and sugar four grains to the ounce. After a week's rest and careful diet the sugar quite disappeared and the hepatic fulness subsided, the urine became abundant and pale, sp. gr. 1018, numerous oxalates. The third case is that of a tall well-built man training himself in this way: he walked before breakfast, then took porridge or cocoa, and tricycle exercise afterwards to free perspiration and fatigue; soon he could neither eat nor sleep well, he felt thirst, the tongue was red and rough; urine free, 1027-30, nothing wrong except one grain of sugar to the ounce. During a fortnight's rest and fit diet he regained his sleep and appetite, thirst less, urine free, 1026, deposits pale lithates, only a trace of sugar. Next month he had got back to his full weight, 13st. 10lbs., and he was quite well; urine clear, sp. gr. 1023, no sugar, but orange opalescence with cupric test. This discolouration was noted at the same time in a very active man, æt. fifty-six, a great pedestrian, who had lately overdone his walking powers and had an obscure form of sciatic neuralgia; also in an elderly man with sciatic pain or lumbago. My last case is that of a healthy-looking man æt. forty-three, who had symmetric pain in the middle of the thighs, with depression of spirits, there was increased hepatic fulness but a clean tongue; the urine was loaded with lithates, and not only gave the red opalescence with Fehling's test, but a well-marked indication of sugar; this was removed with a few days' care and the hepatic fulness disappeared. He has at other times had gastric symptoms purely neurotic, and once lately the hypochondrial fulness has returned but not the glycosuria. In only three of the last fifteen cases is there evidence of co-existent hepatic disturbance, and in two of these it would seem that the increased area of liver dulness might be owing to fatty change, which would continue whether glycosuria were present or not. In two of the more persistent cases the evidence of cirrhosis with other degenerative changes renders the presence of a previous hepatic hypertrophy probable.

In several of the cases under review, and in many really diabetic, attention has first been directed by some curious and perhaps bilateral neuralgias to the possible existence of glycosuria ; in others anæsthesia, as of the soles of the feet or loss of tactile sensibility, has been noticed, with loss of knee-jerk in some of them. In only one of my cases have ataxic symptoms appeared, and those six years after the occurrence of glycosuria; yet old sufferers from ataxic pains have rarely afforded an instance of this coincidence, which, however, has been known to occur. On the other hand, it is impossible to look back over a large series of diabetic patients without noticing how often nervous shock, mental trouble, or anxiety and fatigue, or over-exertion, have been concerned in determining this condition, and, excepting some cases of constitutional failure or of inherited tendency to this state, without conjecturing how many might have escaped the worst consequences of diabetes could rest and care have been adopted on the first appearance of glycosuria !

The number of cases of glycosuria here under review, though of themselves insufficient to warrant any very general conclusions, are not without value ; they show the degree of frequency with which this class of case occurs in proportion to the incidence of other ailments, and they admit of comparison with the deductions commonly received as to diabetes. They correspond very closely to the latter disorder as to the age at which both are most frequently met with, and agree with many of the chief features of the more serious disease. But they are at variance with other characters ascribed to diabetes, and especially with the often recurring statement that "men are more liable than women to this affection;" they, however, agree with, if they do not surpass, Bouchardat's estimate that glycosuria occurs once in every twenty invalids among middle aged persons of the well-to-do classes. Quite recently Dr. Lecorché has asserted the very great frequence of diabetes in women ; this is in accordance with my results ; together they shew that no peculiarity of race is concerned in such liability

In this series of two hundred cases of all kinds of ailments, exclusive of dispensary patients and children, who have come under my special examination, it is rather by accident than by design that the numbers of each sex should have been nearly equal. It also happens that about half of each sex are under forty years of age ; and, that the numbers of those who have consulted me at my house and of those who have been visited by me at their own houses are nearly equal ; a further division as to the ages of these two classes shews that rather more of those coming to my consulting room are among the younger men. It is this last class that has afforded half my male cases of glycosuria. Where the cases are drawn exclusively from those who came to the doctor for advice, especially in this form of ailment, the number of men would naturally exceed the number of the women who apply in the same way and thus the proportion of men to women seen in the consulting room is greater than in reality it should be ; in some statistics it has exceeded two to one. Now in the cases under notice this proportion is reversed, there being twenty-one cases among women to ten among men, and at the ages most apt to glycosuria and diabetes, forty to sixty years, the proportion of women to men is actually three to one. In looking back over the comparatively small number of confirmed or fatal cases of diabetes that have come under my own observation the incidence in men has been greatest, but not to any great extent; and in instances of family predisposition sisters have in my experience suffered in a very marked manner. Even if diabetes be more fatal with men, and the Registrar-General's returns sanction this view, my experience points to glycosuria being more frequent among women, and specially at the particular ages when diabetes is most common in both sexes. The question then arises why glycosuria should more frequently pass into the more serious condition in men than in women. One probable reason for this is that women can more easily, and perhaps more frequently do, obtain rest when the first feeling of illness begins ; they certainly are more careful in carrying out the doctor's instructions when the disease is established. In one case, fatal to a young woman, the existence of diabetes was not suspected till thirst, emaciation, and other advanced signs had gone too far to be arrested, yet the condition had probably existed since an attack of scarlet fever ten years before. It is not unusual after middle age to find nearly an ounce of sugar excreted, unchanged, daily by the kidneys for years, with very little impairment of vigour, till finally pulmonary congestion, phthisis, or a carbuncle happens, and the diabetic state receives no mention. This is more likely to occur when the dietary has been for a time neglected. It is known that in the course of diabetic pneumonia, as in other intercurrent febrile states, the excretion of sugar is often interrupted, so that the existence of glycosuria during such illness may be unknown ; hence many fatal cases escape notice under the heading "Diabetes" in the Registrar-General's reports.

It might be objected that the majority of my cases are in nowise related to those of a more persistent glycosuria liable to pass into diabetes; that a trace of sugar is not uncommon, and that a temporary glycosuria is well known to occur in the course of some diseases, or during convalescence. Three of the above cases may be so objected to; but, they occur in the three youngest persons out of the whole thirty. In the other cases more than a mere trace of sugar was found; in some of them as much as six, eight, and ten grains of sugar to the ounce. Moreover, these cases fall at precisely the ages when the tendency to diabetes is greatest. Of the men three are over sixty years, three are over fifty years, three are nearer forty years, but all are over that age. Of the women ten are over sixty years, four over fifty years, and three over forty years of age. Another objection may be made that those are all cases of gouty glycosuria, a state which, by definition only, is made to be unimportant, transitory, and of slight amount. Two only of my cases have clearly a gouty history; one is of spare habit, the other is stout; both are chronic invalids; in both the glycosuria is permanent, and in the shorter and older subject soon reaches to a considerable amount whenever dietary precautions are neglected. Again, if most of these cases are gouty how is it that two thirds are women, while gout is much more frequently met with in men. Glycosuria is in fact only one of the signs of disturbed nutritive processes. Impaired nutrition may happen to all, at any age; it must occur with advancing years, and glycosuria is one evidence of it at least as likely to occur in women as in men.

Professional misuse of the term "gout" has become, or is becoming, so general that some protest against this laxity of thought and of expression is a necessary preface to the further consideration of the subject in hand. Any obscure pain in young or old is loosely called gouty; every neurotic accident in the young or middle aged is attributed to "gouty acid," or a "gouty tendency;" and every sign of the various organic failures that mark the ingress of age is gout! Our patients more readily submit to this impeachment than assent either to the bald assertion that senile degeneration has commenced, or to the mere truism that they are not so young as they have been. Analysis ought to be carried a step beyond what is implied in these terms, both for our own satisfaction and peace of mind, and for the benefit of our patients' health. To speak of gout in every pain we are called upon to cure is to be like the bonesetters, who find in every stiff joint "dislocations" which they profess to reduce: for both ignorance is the only extenuating plea.

After middle life when repair is less active, and waste matters less readily eliminated, a new balance between ingesta and expenditure of energy has to be assumed. Very often the amount of work should be diminished rather than the amount of food. When the quantity of food taken at one time is lessened the times for taking it have to be increased. If increased elimination be desirable, and diminished supply also advisable, it becomes doubly necessary to refrain from even ordinary exertion and fatigue; or, some one organ may be impeded in its action, and that has to be relieved before all will work smoothly. Where none of those impediments exist a little good wine or well-advised stimulants will help over the difficulty; it is a very quiescent gout that is relieved by old port, however matured. In other cases a more slow but sure way out of pain or discomfort is found from enforced rest and steadily increased feeding; the converse of this is required in hysterical cases where increased exertion or work of some kind is a necessary preliminary to a full diet.

These diverse disturbances of assimilation and nutrition, and the various combinations of them met with, are spoken of as gout, mostly or often with the reservation of "suppressed" or "latent" as a prefix. When increased waste and checked elimination befal one in vigorous middle age, neglect of the usual warnings leads to febrile and arthritic complications, even in those who have no inherited liability to gout. Something like this is seen in children when a sudden attack of scarlet fever is followed by rheumatic symptoms. Moreover, in all febrile processes the nitrogenous waste and even the nitrogenous food is broken up into glucose, to be used in the increased heat production, and into urea with uric acid. The increased quantity of uric acid resulting from the large supply of beef tea, soups, and jellies, to invalids and convalescents is perfectly well known and understood.

In later life the tendency to form or deposit uric acid becomes more marked in some people, and then with closer relations to the arthritic than to the gouty diathesis. Glycosuria is not unfrequent in those subject to uric acid in excess, and sometimes alternates with marked sabellous deposit. It almost implies uric acid, for albuminoids break up into sugar and urea, and extra nitrogenous food will account for some of this excess. This is certainly not the gouty glycosuria usually mentioned, for in no cases is the benefit of a rigid dietary more quickly manifest. Quite recently on a vigorous man of middle age, four days of careful abstinence from sugar, bread, and starchy food, removed all trace of glucose from the urine; this had been six to eight grains of sugar to the ounce with fear of acetone, as perchloride of iron instead of causing any deposit gave at once a clear red-brown colour to the urine; the specific gravity had at the same time fallen from 1030 to 1020 with an increase of urea and considerable deposit of uric acid; the usual deposit with perchloride of iron was readily soluble in excess but without alteration of colour; this iron test, though not alone a proof of acetone, is often a guide to faulty assimilation, when instead of turbidity it gives rise to a clear red-brown colour. An intermittent glycosuria was described by Dr. Bence Jones in 1853, where sugar alternated with lithates. Claude Bernard also refers to an alternating diabetes where uric acid appeared in the intervals. In several of my cases, with after deposit of uric acid, the sugar did not reappear upon return to a mixed diet; in two of these more time must pass before we can know if they relapse.

Decrepitude advances in another mode, wrongly ascribed to gout, with altered arteries, granular or contracted kidneys, and changes in the heart or liver. It is not always easy to say on what these depend, this was a difficulty debateable in Shakespeare's time,[1] and though not yet cleared up some advances have been made in the elements of discrimination. The effects of heart disease on other organs is better understood, how failure to send on the blood enlarges the liver, how too much cardiac force with inelastic arteries are related to contracted kidney. Alcohol has its part assigned to it: and, when deposits of urate of soda are found in the kidney, in the coats of the arteries, and in the fibrous tissues or cartilages, it is known that gout is concerned in the associated diseases. Without such limitations we should be forced to conclude gout to be a disease affecting the lowest classes rather than the highest, and to be as common in the hospitals of London, Paris, and Edinburgh, as among our upper classes and the aristocracy.

Glycosuria may occur with any of the above conditions; it is rather when in combination with degenerations, not gouty, of various organs that it is met with to a slight extent only, and with little liability to sudden increase. In this association extreme rigidity of diet is neither requisite nor beneficial; very often the quantity of urine is but little increased and its specific gravity very low, even down to 1.006; or, with a normal specific gravity the quantity is much reduced, albuminuria with tubular casts occur; perhaps also sickness, with the red tongue and dry centre of chronic renal disease. In some such conditions as these the arrowroot and skimmed milk diet now and then recommended may be appropriate. There are other cases where albuminuria has been occasioned by the prolonged excretion of sugar, and in those a restricted diet should precede the cautious use of milk, or the adventure of paradoxical methods of treatment. Why butter-milk or skimmed milk should be advocated in glycosuria has never yet been satisfactorily explained. All the sugar of milk remains in those two varieties, and only the cream and butter, specially suited to the diabetic, are abstracted. Frequent experience has shewn that until milk in large quantities had been replaced by the sparing use of cream, glycosuria could not be overcome. On the other hand glycerine, which theoretically might be expected to form glucose, may be used in some quantity. An ounce daily has been given without any increase in the amount of sugar appearing in the urine.

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[1] Henry IV., part ii, act i, end of Scene 2.

Great caution is always to be observed in the first dietetic directions on glycosuria being detected. Unless there is already diuresis, or the quantity of sugar exceeds one grain to the ounce, no special diet is advisable. Sugar may be objected to as likely to cause acidity ; and a passing caution may be given against oatmeal, rice, corn flour, and starchy foods. The quantity of bread and of potatoe may be limited on the score of digestion, but it is better not to cut off potatoes at once, they afford much less starch than an equal bulk of bread. In toast the bulk of the bread is lessened and so the proportion of starch is increased ; thin new bread and butter is preferable. Gluten rusks to eat with or after dinner, if procurable under some other name, can be enjoined with more safety and less alarm to the patient than is risked when potatoes are prohibited. To avoid this common vegetable attracts the notice of friends, who speak mysteriously of diabetes and frighten the patient into endless forms of rashly imposed penance; either a routine treatment is begun with undue strictness, or further medical advice is sought, when perhaps, the glycosuria has disappeared, and a doubt arises if there ever were occasion for any treatment at all. In the most severe cases there is more danger from disgust of all food than from moderate indulgence.

Persistent glycosuria established before middle life is reached has a much more serious outlook than when commencing after the fortieth year ; even then, when fully established, constant care as to diet and mode of life is requisite ; it is said to be less serious in stout persons, a proposition which amounts to this, that a progressive loss of flesh shews nutrition to be already impeded. Prognosis depends more upon the habitual amount of sugar excreted than upon the body weight, unless something be allowed for the relation of the one to the other.

No case is without cause of anxiety, if, after a strict dietary, the urine contains four or five grains of sugar to the ounce, that is, about one per cent. To be of medium severity the proportion should be considerably below this; the case is severe if the sugar reaches three per cent., and with fifteen or more grains to the ounce would soon prove fatal. A man of twelve or thirteen stone weight, living carefully, may pass half an ounce of sugar a day safely, while another of nine stone would be in some danger if excreting half that amount constantly. In thin people with profound disturbance of nutrition, this amount would result in cutaneous or pulmonary obstruction, with other complications likely to prove fatal. A young person has been known to excrete fourteen ounces of sugar daily by the kidneys and yet improve under a moderately restricted diet; but, with no very hopeful prognosis.

It is estimated that from four to six or seven ounces of glucose are passed into the blood every day, to be utilised in the work and nutrition of the body. Sugar is the immediate material both for heat and work; the more active the vital changes going on, the greater the transformation of glycogen. The limit to this, fixed by the amount of oxygen supplied in respiration, is about twenty-four ounces. Glycogen is formed in the muscles as well as in the liver, and, after food, is stored for use during active exercise and accelerated respiration. In prolonged fasting more sugar is formed in one day than all the glycogen of the body would yield. Here albuminoids are reduced to sugar and urea; fats are utilised, and so, perhaps, glycerine, but none of these substances supply sugar in ordinary nutrition. In such loss of flesh a little farinaceous food, given with fat, cod liver oil, or butter, checks the nitrogenous waste. The formation of sugar is a necessary vital process; it is always going on, and that to a greater degree than is usually supposed. This formation may for a time be in excess, and during some impaired control over the first nutritive changes, the increased formation of sugar may continue; but in most cases of glycosuria there is no increased formation of glucose, but an interference with the subsequent molecular changes in respiration and nutrition which arrests the constant transformation of sugar, and hence its accumulation in the blood. It may be that a slight excess tends to excite the hepatic function, so acting like a ferment in determining a further increase; or a certain excess may act on the nerve centre, and so weaken the controlling power. There can be no glycosuria without a preceding hyperglycæmia; and this, excepting some cases of diabetes, and in some cases of transient glycosuria, must at first have been from error or arrest of nutrition, and not from over-production. The kidneys are concerned in no other way than in removing the excess. Prolonged overwork of this kind leads to hyaline changes of structure, not limited to the secretory organs; other waste products accumulating act in the same way. The continued excess of sugar in the blood, and of biliary salts acts on the myocardium, and so weaken the heart.

Arrest or disturbance of the normal molecular changes in any part of the body may start glycosuria, just as azoturia depends on imperfect nitrogenous metabolism, the kind of change being determined by some special predisposition, often hereditary. The place held by oxaluria may be either distinct from or intermediate to the above, and it marks a grade between glycosin and urea; it is also a step towards uric acid. Chemically, oxalic acid differs from glycogen, not only by an increase of oxygen, but by dehydration, a change precisely the reverse of that from glycogen to sugar. Clinically, it appears as crystals of oxalate of lime in the urine, under conditions very similar to those in which uric acid is deposited. It is not unfrequently associated with a temporary albuminuria. The albuminuria has in some cases seemed to be excited by the presence of these crystals; in one case hæmaturia appeared at the same time. Besides the instances given of the co-existence of oxaluria and glycosuria, there is one of the series in which it preceded, and one in which it followed upon that condition.

Oxaluria is noted in twenty of the two hundred cases here reviewed. Of these, seven men were seen at my house; three of them were under forty, and three women, all under forty years of age. Seen at their own homes were five men and five women, all more than forty years old. Three of the men seen here, one young and two old, had nervous ailments to the verge of sanity. Of the four others, the two oldest were in failing health, and one has since died; the two younger both had albuminuria, from which one has recovered. Of the men seen at their homes, two were weakened by illness, and one had cerebral congestion, with limited incomplete paralysis, one was a senile hypochondriac, and one intemperate. Among the women, in only one case was the condition at all persistent. This was in a spare, temperate, gouty subject, with albuminuria, both ailments passing off completely. In the other cases, neuralgia, dyspepsia from irregular meals, and fatigue or worry were associated. In these cases, altered habits and attention to diet, with the mineral acids at meals, soon restored health. Oxalic and oxaluric acids are always found in the urine. Those cases where the oxalate of lime appears constantly, and not from a temporary indigestion, are often of more serious import. Oxalic acid may be concerned in what is called "acidity," or may be formed and transformed in some nutritional changes; but here the lime with which it is combined must come from the framework of the body, and is an evidence of a profound denutrition. This is so when, as in ricketts, earthy phosphates appear in addition to the common tribasic phosphates. Several instances of oxaluria in children, with ricketts, scarlet fever, and some wasting diseases, have come under notice in a different series of cases.

Oxalates may occur with phosphates, with uric acid, and with the urates. In the latter case, on the addition of hot water to dissolve the urates, the "hummocky" surface of the deposit of fine mucous will be revealed, which is often a guide to the presence of oxalates. Many instructive instances are on record of the occurrences of oxalates in the urine after disturbances of digestion. With some persons, taking champagne at dinner is followed by such deposit. Dr. Lauder Brunton has observed that cabbage for dinner with hospital patients has had a like effect. Some persons must have found rhubarb to disagree in a similar way, or the crude theory that oxalates taken in the food would reappear in the urine would never have been started. Oxalate of lime is the most insoluble of all the urinary deposits; it is neither made soluble by alkalies, as is uric acid, nor by acetic acid, as are the phosphates. It is inconceivable that the large crystals seen in some vegetables, sorrel for instance, could either be absorbed into the blood, or could pass through the capillaries, if their presence in the blood were possible. Any oxalate of lime taken in the food would be passed as insoluble refuse in the fæces. Moreover, sorrel taken freely by convalescents from oxaluria, under my observation, has not caused a return of the oxalates.

Phosphatic deposit, appearing as a cloud in heating the urine, is unimportant; it disappears on adding a little acid. The prismatic crystals of tribasic phosphates form whenever the urine ceases to be acid. A slight taint of acidity may cause the urine to be turbid from phosphates as it passed; it soon becomes clear again with some tonic and a little more out-door exercise. Care may have to be taken against the formation of a local deposit of ammonio-magnesian phosphate where there is vescical catarrh, enlarged prostate, or the presence of the ammoniacal ferment.

Azoturia is easily recognised, and is easily controlled. An ounce of urea should be excreted daily in health; but the exact quantity varies much, and chiefly as to the kind of food taken. It forms more than one half of the solid constituents of the urine, and should be in the proportion of nearly two per cent. to the whole quantity passed. If, in the adult, in the absence of fever, the proportion of urea exceeds this, a less nitrogenous diet and more diluent should be taken. Before judging of such excess, the quantity of urine passed in the twenty-four hours must be ascertained, as well as its specific gravity. It is obvious that forty ounces at 1025 is equal to fifty ounces at 1020, and that thirty ounces at 1030 equals sixty ounces at 1015 in the contained solids. In urine of higher specific gravity, excess of urea is shewn by adding an equal bulk of nitric acid in a test tube, when, after standing in a cool place, crystals of nitrate of urea are formed. Excess of uric acid will appear in crystals on adding one twentieth part of hydrochloric acid. This may be found to exist in urine of low specific gravity, with no excess of urea

The reactions of the colouring matters in the urine to certain tests require a short notice. Indican, when present, is found by adding a few drops of the *liquor calcii chloridi* to equal parts of urine and of strong hydrochloric acid. The blue colour produced is indigo; this can be separated by shaking with chloroform, which in subsiding carries down the blue, and leaves a purple-red fluid above. Sulphuric acid will give a bright rose-pink colour, supposed to be acetone, in some cases of extreme illness. This colour, if due to acetone, is removable, or may be prevented by heat, and is changed to a fine orange by perchloride of iron. The tincture of perchloride of iron alone, in these cases, gives a red-brown colour, with little precipitate. This reaction takes place after boiling, if the test tube is again cooled, while acetone would have been expelled by the heating. In a totally different class of ailments, the precipitate, formed by a few drops of this solution of iron, and re-dissolved by the addition of a few more drops, assumes a red-brown in place of the yellow colour of the iron. When the urine is loaded with lithates, it may be diluted one half, and slightly warmed before testing in this way. The deposit with iron is sometimes due to peptones, when a further coagulation occurs on heating after the addition of the iron. This is re-dissolved on adding strong acid. The red-brown colour is not changed by heat or acid. It is discharged by chlorine.

Tincture of the perchloride of iron shows the rapid appearance in the urine of the salicylates, when given as medicine, by the deep purple colour produced. This colour is destroyed by mineral acids, but chloride of lime only makes it a lighter red. The general dark hue produced in the urine by the absorption and oxidation of carbolic acid is well known. The yellow discolouration from santonine, or the red colour of chrisophanic acid, as after taking rhubarb, are both distinguishable from febrile discolouration or the bile pigments by being rendered deeper by caustic alkali, and removed by acids. Nitric acid, mixed with healthy urine slightly deepens the colour; a few drops trickled down the side of a test tube should neither give an opaque layer from albumen, nor the pink ring at the point of contact with the urine. This last may indicate disturbance of hepatic function, better remedied by rest and a generous diet than by aperients and restricted food, especially when unaccompanied by any tenderness or increased area of dulness over the hepatic region. The too active liver of diabetics is liable to a recurrent form of inflammation, in which epithelium detached from the smaller ducts furnishes the nuclei for cholesterin deposits. Hence, multiple gall-stones. In these attacks saline aperients or mineral waters are useful.

The kidneys, while often guiding to disturbance of other parts of the body, always give unequivocal and certain evidence of their own disorder. All pain, sense of weakness, or other sensations giving rise to a suspicion of renal disease are to be put aside and the state of the water alone appealed to; testing this will clear up and very often remove all doubts as to anything wrong with the kidneys, and this alone not unfrequently reveals mischief when none was suspected. With early nephritis in the glomeruli and smaller tubules the urine is much reduced in quantity, with high specific gravity, and is often dark, perhaps with admixture of blood; in hepatitis also it is high coloured and scanty, and continues loaded with pink or dark lithates in commencing cirrhosis; but in the latter case, unless kidney and liver are affected together, there will be no albuminuria, In chronic renal mischief pale urine of low specific gravity is common, seldom without albumin, and never without microscopic evidence of disease; this, and a careful estimate of the reduced quantity of urea eliminated, will always guide to the degree of renal inadequacy existing. Specific gravity alone is no guide; once with this at 1027 the quantity was only 15oz., and only eighty grains of urea eliminated per diem. Under treatment the relation of specific gravity to quantity altered, but the urea never came up to four drachms, or half the normal, and the patient's health continued invalid and precarious.

Two-fifths of all the nitrogenous waste of the body has to be secreted as urea, so that loss of this special renal function is irremediable, and more danger is to be apprehended from continuous deficiency of this element than from the accidental presence of albumin or of sugar. The opposite conditions of excess and defect of urea are allied by closer bonds than are seen at first sight. In children, with less nitrogenised waste and a less azotised dietary, the quantity of urea formed is proportionately less than in adults who work hard and live well. In age the rest and diet of childhood are gradually approached. But no one knows when and how this change comes about, nor the time, if it ever come, when the precept of Ofellus, or Cornaro's dietary for aged persons, as recommended by Sir Henry Thompson, is to be adopted; perhaps, even the opposite system may be necessitated by the failure in assimilation beginning with farinaceous rather than with animal food. The limitations imposed by age are sooner recognised than the first warnings of a breakdown in middle life. At middle age work has become more a necessity or more remunerative; hurried meals are to supply the material for prolonged exertion, digestion is disturbed, some one organ suffers, or an undue strain is thrown upon others, and the healthy co-operation of all is upset. It could be shown how excess of urea by over-taxing the excreting organs initiates changes by which less and less of the work of these organs can be done, and how this crippled state could have been arrested by a timely investigation into the balance of health.

When any feeling of illness leads to a medical consultation the alterations found in the urine not only indicate the presence of disease which might otherwise have remained undetected, but afford valuable information as to the tissue changes in progress; founded on these data directions can be given that often prevent serious illness, and would save from much of the danger incident to sudden injury. The risk of surgical interference would in this way also be much reduced. Many of the explosive accidents that follow, and the alteration of habit implied in the confinement to bed after operations, besides the degree of reaction after shock, would be moderated by attention of this kind; not only the time at which an operation should be performed, but the advisability of submitting to one at all would often be dependent upon the results of such enquiry. Diabetics rarely bear operative proceedings well; when possible some dietary regulation should be carefully observed beforehand. Sometimes it has seemed that carbolic acid given in three to five drop doses, fifteen to twenty minims a day, with chloroform-water for a few days has been of service during the healing of small incisions. It would be of interest to know how far the use of carbolic spray enables diabetic patients to bear the larger surgical operations.

Among the various signs of perverted nutrition glycosuria has received the fullest share of attention from the frequency with which it is associated with other results of arrested nutritive processes, and because its early recognition would largely prevent a more serious disease. The action of the liver in forming sugar, first shown by Claude Bernard, has been recently confirmed by Professor Seegen, of Vienna ; glycœmia is a type of interrupted metabolism ; yet in no ailments are medicines supposed to act on the liver less helpful or more injurious. Most illness, and many phases and sensations of illness are called "bilious" by the public; and the public voice is only the echo of past authority. As physiology advances we shall hear no more of diseases caused by "bile." Bile is a continuous product of the liver neither to be increased or disturbed by drugs, not excrementitious, but a necessary element of nutrition. Dr. Murchison, in his last writings, says, "The constant secretion and reabsorption of bile is, in fact, merely part of that osmotic circulation constantly taking place between the fluid contents of the bowel and the blood, the existence of which is too little heeded in our pathological speculations or in therapeutics. The quantity of fluid which is being thus constantly poured out from the gastric and intestinal glands, the liver, pancreas, etc., and then re-absorbed, is enormous: in twenty-four hours it probably far exceeds the whole amount of blood and fluid in the body. The effect of this continued outpouring is to aid metamorphism ; the same substance, more or less changed, seems to be thrown out or re-absorbed, until it is adapted for the repair of tissue or becomes effete. . . . . In the course of this osmotic circulation, much of the bile appears to be transformed into products which are eliminated by the lungs and kidneys, while at the same time this circulation assists in the assimilation of nutritive materials derived from the food." Here we see the great nutritive work of the liver ; it will form bile and sugar, but not urea and uric acid ; the waste is changed into urea elsewhere.

The views held by present students of medicine become in time the basis of popular ideas and phraseology in medical matters. But the phantasmas of science have their attractions, and some shadow of these shadows will be projected into the future: a fanciful pathology seeks for developing germs in every variety of disease, and for the source of gout in the reversion to a prevertebral embryonic liver type. In the passage above quoted we see on the other hand the results of close clinical observation as well as of careful physiological work. Surely there is more to hope in the future from the advance of sober science, than from the transcendental theory of the present or the empiricism of the past.

ON THE TREATMENT OF DIABETES, AND OF SOME CONDITIONS ALLIED WITH GLYCOSURIA.

Treatment.—Whether diabetes be itself a disease, or a disturbance arising in the course of various diseases, whether prominent in acute illness, or one among the obscure symptoms of chronic ailments, and whatever its origin may be, the conditions to be observed in its management are invariably the same: the first essential of successful treatment is a carefully restricted diet.

During the temporary febrile states of those subject to glycosuria, the use of starchy and saccharine foods and diluents, such as arrowroot, corn-flour, cocoa, barley-water, and gruel, is to be avoided; milk is only to be used sparingly, cream is better; glycerine should replace sugar in cookery, and in sweetening tea and coffee. Lemonade is best made with lemon-juice, glycerine, and cold water; in this white of egg may well be diffused. A little gluten rusk may be allowed, with plenty of butter, eggs, and beef-tea. The conscious subject of diabetes mostly adopts this method of nursing the more trifling ailments resulting from cold or fatigue; beef-tea is habitually substituted for gruel; limes and lemons are known as almost the only fruits free from sugar; all kinds of biscuits are known to be wrong; toast is very deceptive. Toasting a slice of bread reduces its bulk, and consequently the proportion of starch is greater in a piece of dry toast than in a piece of quickly made hot toast of the same size; it is least in new and brown bread. A thin slice of bread and butter, or one bit of hot buttered toast is sometimes taken as an indulgence.

Macaroni and vermicelli, unless specially prepared, have to be excluded from all dishes, and all flour or starchy thickenings from soups. Carrot, parsnip, or Jerusalem artichokes are to be rejected, but a mealy potatoe at its best is now and then permissible. These vegetables contain from fifteen to twenty per cent. of starch and sugar, with seventy-five per cent. of water. Turnips contain five or six per cent. of glucose material, and should be used more sparingly in broths and soups than celery need be. Barley and rice should not be used even in soups, as they contain from near seventy to over eighty per cent. of starch. Pea soup is wrong, as dried peas contain fifty-eight per cent. of starch; this proportion is much less in young green peas, the large proportion of water in fresh and growing plants reduces to a minimum the risk from what may be called the doubtful vegetables. Beetroot and broad beans are inadmissable. Tomatoes and small onions are useful, the large Spanish onion is objectionable; cauliflower, Brussels sprouts, cabbage, sea-kale, boiled celery, vegetable-marrow, French beans, asparagus, and artichoke heads are allowable. The best vegetables are spinach, turnip top, sorrel, lettuce, endive, water-cresses, mustard and cress, cucumbers, and mushrooms. Celery is fairly good; not so rhubarb. If apples could be stewed without sugar, and so of other fruits such as plums, currants, raspberries, and young gooseberries, they would be useful, and perhaps with a little glycerine might be made agreeable. All jams and preserved fruits are bad, so are dried figs, dates, and raisins. Bananas and pineapples are to be avoided; shaddock, oranges, and melons, if eaten without sugar, can be taken sparingly, and even fresh grapes. Peaches and nectarines are the best of all ripe fruits. Strawberries, currants, raspberries, mulberries, and cherries in moderation can be taken. Lemon is the only fruit absolutely without sugar; it is invaluable in every way to the diabetic, with cayenne as a condiment, with glycerine to flavour jellies or cheesecakes, or with iced and ærated waters for drink. Pickles of all kinds help the appetite, and useful aids are found in anchovy or caviare, truffles, capers, horse-radish, or olives. Oil in any quantity, and with any suitable kind of food, is good. Clear melted-butter must replace many of the white sauces that pass under its name. Oyster-sauce, and oysters unless a very few, should be declined. Crab, lobster, and prawns or shrimps are unobjectionable. Fish of all kinds, turtle, all kinds of fowl and game, and all meats are included in the dietary. Calves head, sweetbreads, tongue, ham, bacon, brawn, Bath chaps, and any meat or fish, salted or dried may be taken. Kidneys are good, but not liver or sausages. Cream can be used in soups and sauces, and is to be largely substituted for milk. Cheese, cream cheese, and Devonshire cream are to be recommended, while butter and eggs in any form and guise are essential. Tea and coffee without sugar, and with more cream than milk, are allowable both morning and evening. With the mid-day meal a little sound bitter beer is often most useful. Alcoholic stimulants would generally afford grateful help, but no brandy is without liqueur, and no wine can be quite without sugar; claret is best. Hollands, unsweetened gin, and a pure whiskey without sugar, or in small quantity are fit adjuncts to the diabetic dietary.

Many or most of the things here enumerated are given with greater fulness and more system by Dr. Pavy. We both have attended the early demonstrations of Claude Bernard, are followers of Bouchardat, and have the same scientific basis for insisting on the essentials of diet. My object is to emphasize certain details, and to sketch how the ordinary diet of health has to be modified by those who have shown tendency to diabetes.

The changes in diet generally required involve no hardship; not so much as is often put into practice against obesity. To watch the quantity and quality of all one's food, and to weigh the bread taken at meals is equally irksome in both conditions. Very often this care would suffice to stop the first tendency to glycosuria with more time at meals, some quietude afterwards, and avoidance of over-fatigue. Sometimes however it happens that in the first feeling of disturbed health in this direction a mistaken notion of what is light of digestion, or a sense of epigastric weakness, leads to what is considered as the simple diet of bread and milk, or to oatmeal, or rice, and so the initial error of assimilation is aggravated and confirmed. To most active persons it is no hardship to forego gruel and take to soup or eggs. Cold beef and pickles are to be preferred to porridge and toast, and many adults think lobster salad better than light puddings. No one need take pastry; and, at middle life, jams, treacle, and even sugar can be relinquished without much regret. Any modification of the ordinary diet in the direction indicated may be found sufficient to accomplish all that is wished; the stricter rules of the above dietary are seldom required, and then but for a limited time. Only the impulses of panic put all the crude preparations and bare elementary principles that figure in a diet list on trial altogether, and cut off at once every pleasant variety of food. It should be mentioned that almonds and all kinds of nuts can be taken towards the end of a meal. Almond biscuits as well as bits of gluten rusks help, with the olives, towards the appreciation of a glass of claret.

The first and in many cases the only necessary injunction is to to give up sugar; none but the very young require it as an article of food; and though to some healthy old people, who have what is called a sweet tooth left, it is not hurtful, yet to others it is a source of acidity when not otherwise specifically injurious. Instead of sugar a teaspoonful of glycerine will sweeten a glass of lemonade or a cup of coffee. Both tea and coffee are soon relished without sweetening. A tablespoonful of glycerine will be used most days in cooking either with custard or stewed fruit, and in jellies or salads; an ounce of glycerine daily is a safe and convenient limit. Cream must to a great extent be used instead of milk. At breakfast a gluten rusk should be made hot and buttered; a dry rusk will be required with breakfast, luncheon, and dinner or supper, and one is to be heated and smothered in butter at tea-time, or part of one eaten with a little butter and potted meat or anchovy paste. A very thin slice of bread and butter instead can be taken either at breakfast or tea. Bacon, and eggs poached, scrambled, or cooked in any way, should be a standing breakfast dish. To compensate for the diminished allowance of farinaceous food, fat or oil has to supply the hydrocarbonaceous matters needed. Hence boiled ham or fried rolls of bacon are served with chickens or turkey, and oil or butter with fish or other dishes. When this want is considered in the arrangement of the meals bread is not so much missed, and the bit of rusk put in place of the dinner roll satisfies the careless search for crust or crumb that has then become habitual. At the end of dinner any fragments of these rusks placed with biscuits or pulled bread will be relished with the cheese and celery or salad by all people.

Very variable is the power recovered by diabetic patients of assimilating some articles of diet at certain times which at others would surely lead to a marked increase of their infirmity. Some can indulge in forbidden fruits with impunity, or occasionally a doubtful vegetable. Many can take milk fairly well, or need not entirely abstain from it. Sugar must always be excluded from stewed fruits, and from every kind of drink. The balance of assimilation and secretion arrived at after long care in diet has been so disturbed by a single lump of sugar weighing two drachms, taken inadvertently in a cup of tea, as to determine an excretion of six times that weight of glucose in the next twenty-four hours and to make rigorous care for some days needful to overcome the wrong tendency. There are times when all soluble ingesta should be tried for sugar by Fehling's test, and the bread and sauces with iodine. Starch will be found to some extent in all the prepared flours said to be freed from it, either unchanged or partly converted into dextrin. Prepared flours with the starch converted into dextrin are worse than Deville's or Bonthron's, where some of the starch remains. Gluten bread should habitually form part of the dietary; the rusks made by Bonthron are agreeable, either dry, or toasted with butter. Under careless diet a feeling of weakness, loss of flesh, irritability of manner, or some neuralgic pain, will often indicate an increase of sugar in the urine. This chemical examination confirms, perhaps after it has continued for some time. In such a case a restricted diet has restored, within one week, five pounds of weight to the body, or removed neuralgic pains in two days. A patient, under slightly modified diet, had severe neuralgic pains across both thighs after the fatigue of a journey to London; this ceased shortly after all starch, milk, and sugar had been avoided.

When glycosuria is first detected during an attack of severe illness, it may be difficult to say how far diabetes is an accidental complication or an underlying condition, and impossible to estimate the originating causes at work; hence may arise a caution as to prognosis, but there is no place for hesitation as to treatment. Mostly in grave disease, as of lung or kidney, the diabetic condition has been foreknown, perhaps guarded against by a partial avoidance of starchy and saccharine food; in these cases, restrictions, which had been gradually relaxed as one or another slight departure from a rigid dietary had been found possible, have now to be reinforced. Where this condition had not been suspected, the safety of the patient will depend upon its early recognition and prompt treatment. The good effects of a rigid dietary have to be waited for with more patience in presence of a confirmed diathesis than where glycosuria may be dependent on a less persistent cause; but in either case steady perseverance in the same line of treatment is required, however different may be the primary causes.

Convalescence from certain severe forms of illness is liable, as we have seen, to be interrupted by the occurrence of glycosuria; this, if exceptional after diarrhœa, is less so after cholera; it also follows some febrile attacks. During fever the nitrogenous waste is great, perhaps greater than the excretory means of the body can well deal with, hence amylaceous nourishment is needed; on recovery there should be a craving for meat to restore the previous waste, and it is a mistake to impede its digestion by giving the basins of gruel and rice which hitherto had been taken readily. In some such cases Deville's gluten macaroni, and vermicelli could be added with advantage to soups; in actual glycosuria a strict dietary should not be delayed.

A dietary founded upon the above principles may be made most efficient in combatting the tendency to obesity incident to middle age, when the elimination of waste matters is impeded. Excess of uric acid, and its liability to deposit, is best controlled under a full diet of fresh meat, with a restriction as to bread, pastry, some vegetables, and all sweets. Oxaluria, alternating with excess of uric acid, may determine concretions that are by all means to be avoided; here caution is required against a lowering plan of treatment, and against the abuse of mineral waters, as well as against the use of sugar and excess of vegetables.

A plan for the strong and active of taking full draughts of hot water an hour before meals, with fresh meat or eggs at each meal, promises well. From half a pint to a pint of water at 120° to 130° Fah. (50° to 55° centigrade) is taken three or four times a day for two or three months, or until the body weight is adequately reduced, the proportion of animal to vegetable food during this time being three to one; this is afterwards kept at two to one; and two of the daily draughts of hot water only, morning and noon, are taken. This plan has the advantage of aiding the removal of waste matters from the body without adding any new element to complicate the delicate chemical processes concerned in nutrition transformations. The high temperature at which the water is taken renders it a gentle gastric stimulant, it has little other efficacy; whether hot water will reach the stomach at any temperature beyond 120° is doubtful; the most inveterate tea drinker pauses at a cup of his, or her, favourite stimulant at the scalding temperature of 140°; if any be swallowed above 130° it is delayed and loses some heat before it reaches the stomach. But cold water in any quantity would chill and lower the tone of the stomach, less so with a moderate degree of saline impregnation. Some of our thermal waters are available as diluents and deobstruents; others contain lime enough to favour the deposition of oxalates, and it is questionable whether many of the vaunted table-waters are not too hard for habitual beverages. The strongly alkaline waters are much abused at meals and otherwise; they are chiefly resorted to by the public when urinary concretions already exist, and thus the effect of these waters is to exaggerate the ills they are supposed to obviate. Soda repeatedly taken to relieve heartburn leads to crippling deposits in or near the joints, and rigidity of the main arteries. The best drinks, either dietetic or diluent, are the simple aerated waters, such as are made at home in the gazogene, or supplied as "Salutaris;" they mix agreeably with a little lemon juice.

Another combination of ailments, equally common to the spare and the stout, where vertigo, heartburn, flatulence, palpitation, retching, or spasm are symptoms, is found where the urine is free, sometimes very acid, with coarse grains of uric acid separating, sometimes barely acid with phosphates, and often with numerous oxalates in both of those conditions. Here fresh meat is to be preferred to a farinaceous diet, and the tone of the stomach can be aided by the mineral acids and nux vomica with meals; if any alkali is required, half a drachm of bicarbonate of potash in half a tumbler of water taken before a meal is best, or soda can be given with sulphate of soda before breakfast in the effervescing form without fear of these salts acting injuriously; their slightly aperient effect is mostly beneficial.

In confirmed diabetes where diet is strictly attended to, and made the chief part of the treatment, it is well at first to give no medicine at all. Care must be taken that no undigested food or waste matters be too long retained in the stomach and body. Carlsbad and other aperient saline, or mineral waters may be taken before breakfast, but mercurial and strong purgatives are to be avoided. If sugar be always present in any quantity, dietary restrictions as to the amount of azotized food is also required; and with limited food the amount of exertion is to be proportionally reduced, and the waste of the body minimized. The alkalies or alkaline waters are much more rarely useful than is generally supposed; with a largely nitrogenized diet acid urine with more urea results; in these cases an extra cup of tea, or the addition of lemon juice to the ordinary diluent is all that is required. La Bourboule, taken with or after meals, is the only mineral water general useful.

My distrust of the efficacy of alkaline mineral waters in diabetes extends beyond the common salts of soda to any power claimed for salicylate of soda; it may check the formation of lactic, and consequently of butyric, acids in some complications, and it has been used with success in the symmetrical neuralgia of this state; but, without the drug, these neuralgias usually subside after careful dietary. Further, the remedy had no effect on the diabetes itself in several cases under my own observation. In one of these cases the utter uselessness of the Bethesda water was fully demonstrated some years ago; this proof of its inefficiency did not deter my patient from undertaking a journey to America to try its worth at the source, but with no favourable result. The water itself is not much more than a common table-water, a little too hard for ordinary use, but harmless and inert in moderate amount. In large quantities it is injurious, in the same way that a large quantity of any fluid is injurious in diabetes; with the further danger, not imaginary, but confirmed by distressing experience, that misplaced confidence in a futile resort leads to neglect of ordinary precautions, and so to danger and to death.

At the commencement of treatment, ascertain first what degree of improvement takes place from care in diet, then note the further modification that can be brought about by medicines. Those that act on the contractibility of the blood vessels through the medium of the nervous system are of most service. Nux vomica and ergot, or matico, have been found useful, also iron with strychnine or quinine, and better still with small doses of arsenic ; a solution with three or four grains of the former and $\frac{1}{30}$th of a grain of the latter taken after meals has had a marked effect in aiding the assimilation of a mixed meal, with either bread or potatoes as part of it, and so controlling the production of sugar. Bromide of arsenic solution given in doses of three drops after meals for ten days, has seemed to be instrumental in reducing the quantity of sugar from two to four ounces in the twenty-four hours, after dietary had brought down the amount from sixteen to six ounces a day, in a man under the care of Professor Korányi, of Buda-Pesth. This remedy is rather an uncertain combination of arsenious acid and bromine, moreover its aqueous solution is very unstable, part of the salt being converted into an oxybromide of arsenic, and part into arsenious acid, with liberation of hydrobromic acid. In conjunction with bromide of iron some of these obstacles to its more general use have been overcome.

Of the good to be obtained from codeia, and from extract of opium, in certain conditions attendant upon diabetes, my experience is amply confirmatory ; half a grain of either is given with advantage in a pill, or a solution of codeia with dilute hydrochloric acid after meals. But these means are not to be used in the variable glycosuria of stout persons ; it is rather when an actual and habitual increase of sugar production, not a mere hindrance to its conversion, is suspected that this hepatic sedative is useful. The improvement in such cases secured by aid of these drugs is not merely temporary, nor is it obtained at the cost of any decline of vital power, rather by a conservation of the nervous energy most readily exhausted in diabetes. Once where complete recovery resulted, after three and a half ounces of sugar were excreted daily, codeia in full doses was one of the means employed.

The best results may be expected from treatment as long as all sugar can be, if only for a time, entirely removed. While it persists, the waste products associated with this form of defective nutrition cannot be completely eliminated ; they accumulate in the blood and aid the increasing glycosuria in determining those degenerative changes which often affect sight or hearing, and impair both muscular and nervous energy. Even with a temporary disappearance of the sugar the mischief already done may suddenly declare itself, or be irreparable, but generally a considerable steady reduction in its amount is favourable. There are cases, however, where this cannot be effected; sugar in considerable excess is constantly present in the blood, and not only the excreting organ suffers structurally, but impaired nutrition affects also the nerve centres and the heart. Changes in the myocardium seriously endangering the continuance of the circulation have been demonstrated, and with this the sudden onset and fatal character of what is known as diabetic coma is impending. Acetonœmia is no essential part of this catastrophe. Nor is it dependent upon the formation of oxy-butyric acid, as Stadelmann contends, who, on theoretical grounds, advocates a carbonate of soda treatment; granting in some cases the presence of this acid, yet diabetic coma results from preceding degenerative changes, and is not to be prevented by an alkaline plan of treatment, not even if soda could be given to the extent and in the manner suggested.

Phthisis has happened in young persons as a fatal complication. More often wasting, with extreme thirst and harsh dry skin, occurs without any phthisical signs; here rinsing the mouth with iced water is better than drinking much fluid at a time; or little pieces of ice to suck are grateful; a small dose of pilocarpin may be prescribed with acid for keeping the mouth moist in diabetes; at least it seems well worthy of trial. Moisture is restored to the skin by giving two or three grains of carbolic acid in an ounce of water three or four times a day for short periods; a solution of this strength, sprayed into the mouth and swallowed, relieves dryness of the tongue and throat; this solution of carbolic acid should always be administered during an intercurrent abscess or boil for two days before any incision is practised in diabetic subjects.

Our ability to excite the secreting glands, except by the simplest aperients, is very limited; nor in the treatment of diabetes is this to be regretted, for the kidneys act too much, and there is no marked diminution in the activity of the other secreting organs of the body; the skin may be dry, but perspiration is not uncommon; the peptic glands act freely, for the appetite is large; the liver may be at fault, but is not inactive; lactation is too free in this association; many men diabetic for years are not therefore childless. The activity of the kidneys is directly excited by the presence of sugar; these organs, healthy at first, by degrees suffer from the overwork forced on them.

The two forms of albuminuria met with in diabetes are, perhaps, more readily distinguishable than when uncomplicated in this way. In contracting kidney, associated with gouty glycosuria, the quantity both of albumen and of sugar is small, and the urine is of comparatively low specific gravity; the two conditions have gone on together, the diabetes being the less prominent, and not the primary one. The other form of albuminuria, with parenchymatous nephritis, appears in the course of typical diabetes; it comes on when the urine has been for some time in large quantity and of high specific gravity, and may co-exist with an excess of urea and of uric acid. The first of these two conditions only is that in which a milk diet is to be recommended, or is even allowable; in the second the use of milk must sometimes be at once prohibited. Grave anxiety, caused by the persistence of both sugar and albumen in the urine after many of the restrictions in diet known to be requisite have been put in force, has been relieved shortly after the use of milk has been entirely stopped, and cream exclusively used as a substitue. As the sugar diminishes the albumen disappears and the quantity of urea increases.

In the course of diabetes sugar may completely disappear from the urine in some unfavourable contingencies. It is commonly absent for considerable periods during favourable convalescence; at these times the diet may be varied to almost any extent, and milk need not be excluded. Such disappearance of the sugar must not be considered as cure of the diabetes; let any shock or fatigue shake the precarious balance of health, and a return to the more strict rules of dietary becomes again necessary. Milk must be again prohibited for a time, because of the large quantity of sugar contained in the whey; very little of this remains in the cream, and least in Devonshire cream; cheese and curd are nearly free from it; butter is entirely unobjectionable. If skim milk is to be recommended in diabetes, why not whey? It is free from curd as well as from cream, while both contain all the sugar of milk. Indeed, it is not surprising that sugar has been recommended in diabetes;—could it be given not only on homœopathac principles, but strictly in homœopathic doses, so that all the sugar injested could be reduced to some minute fraction of a grain a day, improvement would soon be evident.

Curd should be more utilised in the diabetic diet. Cheesecakes made with it vary the fare that so much needs variation. The variety of supply for the more substantial dishes is ample; but for the lighter additions to a meal, that make eating less a duty than a pleasure, there is always room for some new combination. An agreeable cheese-cake, baked in ramakin papers instead of in pastry, can be made, with or without gluten bread and curd, in the following way:—Grate one ounce of bread with the rind of two lemons, and mix with half an ounce of glycerine; with this whisk up the whites of three eggs, two ounces of cream, and one ounce of fresh butter, melted by heat; add also the juice of the two lemons, and the yolks of the three eggs, well beaten; mix all together, and bake in ramakin cups for about twenty minutes, in a rather quick oven. A little more glycerine, or a little less lemon juice, will modify the flavour and consistence of this confection: it is to be eaten when cold.

The management of diabetes, besides attention to diet, requires moderation in exercise, very complete intervals of repose, plenty of fresh air, and avoidance of any excess in mental or bodily exertion. To control the exacerbations of the disease, absolute rest as well as rigid diet must be enjoined. At these times, for days together, the quantity of sugar excreted exceeds the amount to be derived from the starchy and saccharine food taken; a considerable amount of it must therefore come from amyloid material, and from waste products within the body. The protein compounds may be represented by sugar and ammonia, and their rapid disintegration may give rise to both products; with a less degree of disturbance this change would be less, some of the ammonia would be converted into urea and excreted as such, while less sugar would be formed. Rest and diet without medicine, in the course of diabetes mellitus, has gradually brought about a great diminution in the quantity of urine, a complete absence from it of sugar, with great proportional increase in the urea; and this favourable change has continued for weeks and months with but rare re-appearance of the sugar, though fruit, wine, milk, and ordinary bread, the greatest luxury to a diabetic convalescent, have been allowed.

A return to the use of a mixed diet, or of some proportion of farinaceous food during the cure of diabetes is next in importance to the restricted diet with the variations that render it endurable. It becomes a matter of serious moment to determine at an early period of the treatment what desired articles of food can be assimilated and disposed of without leading to the reappearance of sugar, or to an increase in the amount to which it has been reduced. This can only be done safely by a daily examination of the urine and a careful estimate of the varying degree of glycosuria produced by the variations tried or the quantity of bread allowed; a similar rule is to be observed when extra work is attempted, or some doubtful luxury indulged. The greatest difference is found as to the individual tolerance of matters in most cases obnoxious; one person can take carrots or Irish stew, another almost any kind of fruit. Apart from these idiosyncracies, there is in every case what Bouchardat has called the "personal equation" to be arrived at, for no two persons require exactly the same directions, and for each one at different times considerable variations become advisable. These must depend upon the results obtained by testing not only as a daily routine but at certain times of the day, and after certain articles of food. A rapid subsidence in the amount of sugar found is always a most favourable indication; in such cases active exercise may at once be resumed and a speedier trial made as to the most suitable variations in diet. When a satisfactory condition is established and ordinary occupations resumed, it may suffice to record once a week the progress made and maintained; with an estimate of the quantity of fluid passed in one day, and the amount of sugar obtained by the cupric test, the following table, with comparative proportions of sugar excreted, is useful for reference:—

Grains to the ounce.		Grains to the litre.		Grammes.			Per centage.	
1	equals	35¼	or	2.3	per litre,	or	0.23	per cent.
2	,,	70½	,,	4·5	,,	,,	0·45	,,
3	,,	106	,,	7· nearly	,,	,,	0.7	,,
4	,,	140	,,	9.2	,,	,,	0.9	,,
5	,,	175	,,	11.5	,,	,,	1.15	,,
6	,,	211	,,	13·7	,,	,,	1·37	,,
7	,,	247	,,	16.	,,	,,	1.6	,,
8	,,	282	,,	18.3	,,	,,	1.8	,,
9	,,	317	,,	20.5	,,	,,	2.5	,,
10	,,	352	,,	22.8	,,	,,	2.28	,,
11	,,	387	,,	25·	,,	,,	2.5	,,
12	,,	423	,,	27·4	,,	,,	2·74	,,
13	,,	458	,,	29·7	,,	,,	2.97	,,
14	,,	492	,,	32.	,,	,,	3·2	,,
15	,,	530	,,	34·5	,,	,,	3·45	,,
16	,,	565	,,	36.7	,,	,,	3·67	,,
17	,,	600	,,	39·	,,	,,	3·9	,,
18	,,	635	,,	41.3	,,	,,	4·13	,,
19	,,	670	,,	43·6	,,	,,	4·36	,,
20	,,	705	,,	45·8	,,	,,	4·5	,,
21	,,	740	,,	48.	,,	,,	4·8	,,
22	,,	775	,,	50.	,,	,,	5·	,,
23	,,	811	,,	52.3	,,	,,	5·2	,,
24	,,	846	,,	54.8	,,	,,	5·4	,,
25	,,	881	,,	57·	,,	,,	5·7	,,
26	,,	916	,,	59·3	,,	,,	5·9	,,
27	,,	950	,,	61.5	,,	,,	6.15	,,
28	,,	985	,,	63.8	,,	,,	6.38	,,
29	,,	1022	,,	66.3	,,	,,	6.6	,,
30	,,	1057	,,	68.6	,,	,,	6.8	,,
31	,,	1092	,,	70.8	,,	,,	7.08	,,
32	,,	1128	,,	73·	,,	,,	7·3	,,
33	,,	1163	,,	75·3	,,	,,	7·5	,,
34	,,	1199	,,	77·6	,,	,,	7·76	,,
35	,,	1234	,,	80.	,,	,,	8.	,,
36	,,	1269	,,	82.3	,,	,,	8.2	,,
40	,,	1410	,,	91.2	,,	,,	9.1	,,

The relation of diabetes to obesity may be shewn by setting forth, first, the directions formulated by Bouchardat for the guidance of sufferers from glycosuria; and, after, some recent rules against obesity.

I.—Bouchardat's general precepts are:—

(1) Eat moderately and slowly; all food to be cut small and well masticated.
(2) Drink as little as possible with meals, and do not take much beef-tea, broth, soups, etc.
(3) Do not drink much at once; cold water must only be taken in sips. The mouth can be rinsed with iced water, or kept moist by slowly chewing an olive, or roasted coffee berry.
(4) Two good meals a day are preferable to three or four.
(5) Avoid resting up, and especially sleeping after a meal; rather take a walk on leaving the table.
(6) Do not go to bed till four hours after dinner, or the last meal.

Exercise, and care as to a healthy state of the skin are also insisted on.

II.—The diet calculated to reduce a tendency to corpulence and also suitable for persons leading a sedentary life may be thus stated:—

(1) Be regular and punctual at or with your meals; if appetite is wanting at meal times omit the meal, or take but little.
(2) Never eat hurriedly, nor when excited or preoccupied.
(3) Take articles of food objectionable in glycosuria sparingly, infrequently, or not at all.
(4) Avoid dishes of unknown composition, or such as are known to be wrong, or to disagree.
(5) The bread and potatoe allowed must be well masticated and eaten slowly.
(6) Take two mouthfuls of animal to one of vegetable food at the principal meals. Avoid the skin, and the fibrinous parts of all flesh, fowl, or fish: hence the savoury surface of roast pork, duck, goose, or of fried fish, is to be avoided; also take but little boiled veal, jelly, calve's head, or mock-turtle soup. In clear soup, shaped pieces of white of egg take the place of Venetian paste; use no thick soups. Avoid corn-flour, oatmeal, cakes, pastry, treacle, and sugar.
(7) Never exceed half a pint of any liquid with meals. A little glycerine may be added to tea and coffee, with lemon juice to tea or in water. Weak Liebig's beef-tea, with or without lemon juice, or equal parts of wine and water, can be taken with a meal, or one ounce of brandy, gin, or

whisky, in half a tumbler of water. Avoid champagne, soda water, iced water, bottled beer, ginger or lemonades with meals; also ices and liqueurs either with or after meals. To prevent thirst, drink half-a-pint of plain water an hour before each meal, and as much at bed-time with a little lemon juice or other addition.

So far, these directions are equally suitable to the more serious as to the slighter disturbances of health. It is, however, a mistake to suppose that stout persons should not take much liquid. The quantity required in health varies with body-weight, season, and amount of exercise; most of it is best taken some time before meals or after exercise. In disturbed health with gastric or renal irritation, neuralgia, some kinds of asthma, or in eczema, nearly a pint of quite hot water, taken an hour before breakfast, at noon, and at night either before supper or an hour before going to sleep, is in my knowledge remedial. This therapeutic use of hot water, advocated by Dr. Germain Sée, has been largely practised and found to be of service without many of the restrictions that have been attached to the original prescription.

No dietary can be safely followed from which fatty matters and farinaceous foods are both excluded. When food is limited in amount it must be highly nitrogenous; the addition of fat, cod liver-oil, or butter to such a dietary stays the craving, felt by the strong, for more at a meal, enables weakly persons to assimilate better the small supply they can take, and lessens the waste of tissue going on in illness. The necessity for extra fluid during any febrile disturbance in the body is well known, and one of the first cares of nursing is to supply this want. Nine-tenths of our food is water, so when meals are reduced in bulk the missing water has to be added as fluid, or in fruit, etc., not as alcoholic stimulant. It is to this last element, and not to a meat diet, that renal mischief is mostly due.

The gouty, necessarily restricted in the use of alcohol, require a fair amount of animal food. Strong soups and jellies leave more waste matters for renal elimination than do fish, flesh or fowl. It cannot be shown that fresh meat ever excites kidney mischief; nor, indeed, that it favours the increase of uric acid. Yet in the *Medical Annual* for 1886 (p. 172), a too facile pen has slipped into writing of "diabetics hurried to their graves by Bright's disease set up by . . . lean meat." The propriety of attributing well-known accidents of a disease to incidents in the treatment has already been called in question. Albuminuria is known to be a frequent concomitant of glycosuria; in twelve hundred instances of the latter, recently tabulated at Carlsbad, one-third had albuminuria. This proportion would be higher if no case were included with less than two grains of sugar to the ounce; so that the persistence of glycosuria increases the tendency to renal disease, and a meat diet, by checking the one, would prevent the other. It is only where the quantity of albuminous food far exceeds the assimilative powers that albuminuria results. Claude Bernard notes this occurrence after a large number of cooked eggs had been eaten; my own experience is, that six boiled eggs may be eaten at one meal with no ill result. Dr. Lauder Brunton, after six raw eggs, had headache and sickness, but no albuminuria. Dr. Grainger Stewart records three cases (*Practitioner*, Vol. XXXIX., No. II., p. 109) where nine and ten raw eggs were taken daily in addition to the ordinary food for three, seven and nine days with temporary albuminuria; two ounces of cheese with an ordinary meal in twenty lads had no effect of this kind. The rule here is the same as for milk diet; avoid excess, and be careful not to impair digestion. Both albumin and sugar in small quantities are frequently found when digestion is imperfect.

The after changes of assimilation and nutrition are more obscure than those of mere digestion; they consequently lead to greater discrepancy of view and wider range of theory. A return to the discarded acetone theory reproduces the old errors of the alkaline plan of treatment in diabetes. When Chevreul, now an active centenarian, first shewed that an alkaline state of the fluids favoured oxidation of the heat-forming elements of food into carbonic acid and water, a theory arose of diabetes resulting from want of alkali in the blood, and consequently carbonate of soda was given in large doses, in some cases to the extent of four or five drachms daily for ten or fifteen days. The results of six cases so treated were published in 1846; in all both the quantity of urine and the percentage of sugar were increased, the latter in some cases to a very great degree. Two of the more advanced cases died, one of pneumonia and one of coma; known accidents of the persistent disease which soda can neither directly produce nor in any wise prevent or avert. The blood is not acid in diabetes, but the urine is; and the new theory would connect this acidity with the acetonæmia of the past. Minskowski finds much of this acidity due to β oxybutyric acid; this splits into aceto-acetic acid and carbonic acid, oxidation of aceto-acetic acid or of oxy-isobutyric acid, will yield acetone. But acetone only sometimes appears in diabetic urine, and when present in the blood under other conditions, or however administered, has been proved not to produce the symptoms that have been ascribed to it. Yet a writer in Cassell's Year Book of Treatment (for 1885, page 67), assumes a toxic agent in diabetic coma, derived from the butyric or formic acid series, which is to be got rid of by alkalis, the vapour bath, and perspiration. In support of this view, a case is mentioned where Hoppe-Seyler found acetone in the urine after poisoning by sulphuric acid; but, as acetonæmia and diabetic coma are not identical, but only theoretically and accidentally related to each other, the argument is hardly strong enough to win our assent, and still less well-founded for a basis of treatment. One reason why we meet with a recurrence of this treatment is that the rule "for glycosuria give soda" is easier to bear in mind than the chemistry of foods, and the constituents of a large number of suitable varieties; hence a tendency to fall back upon a simple formula even when the theory breaks down on which it is based.

Potash and lithia water are sometimes prescribed with success when uric acid appears; but it is precisely in these cases that, as Prout long ago pointed out, the prognosis is most favourable. Arthritic symptoms have not unfrequently preceded glycosuria; the same is said on the high authority of Dr. P. W. Latham of transient diabetes as the harbinger of a gouty attack. We may conclude, where the Croonian Lecturer for 1886 at the Royal College of Physicians begins, by repeating that in these three diseases there are in all changes of the blood, resulting from abnormal metabolism; that these changes differ in each of them; and, that in the pathology of these three disorders there is still much that is obscure and unsettled. The subsequent Bradshawe lecture at this College, in controverting the views here brought forward, has failed to disturb them.

It is to be noted (*vide* p. 20) that after the absorption of sugar the change in the body is from glucose to glycogen by dehydration; a further change in this direction might lead to oxaluria, and be quite distinct from the formation of uric acid. The fatty acids pass into the aromatic series (acetylene into benzine) by dehydration, with liberation of heat; the hydrocarbon nucleus acquires stability by a corresponding loss of energy.

ERRATUM—p. 15—for "SHORTER" read "STOUTER."

McC.